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PC Labs Tests the
First 50-MHz 486 PC:
Dell's PowerLine 450

SOFTWARE

15 Tools That Clean
Up Your Spelling
And Improve
Your Grammar

GRAPHICS ADAPTERS

21 Affordable
Super VGA Boards
With More Colors and
More Horsepower

MAGAZINE

SEPTEMBER 24, 1991

THE INDEPENDENT GUIDE TO PERSONAL COMPUTING

VOLUME 10 NUMBER 16

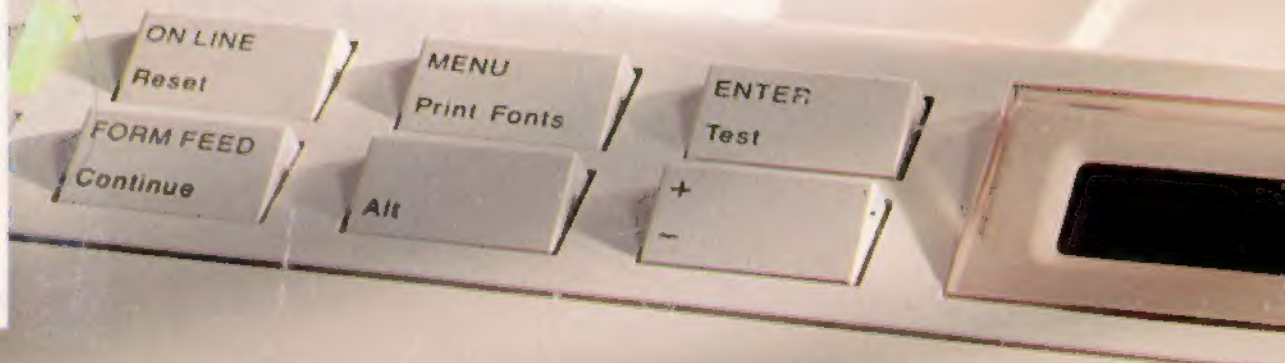
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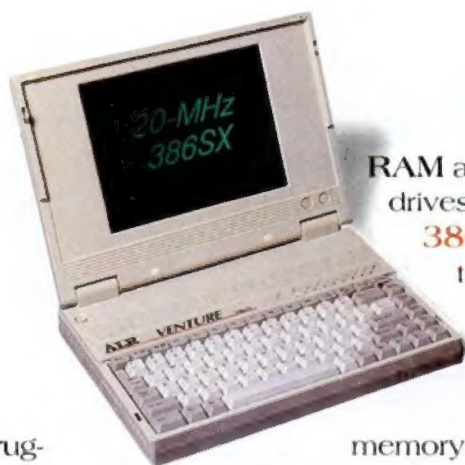
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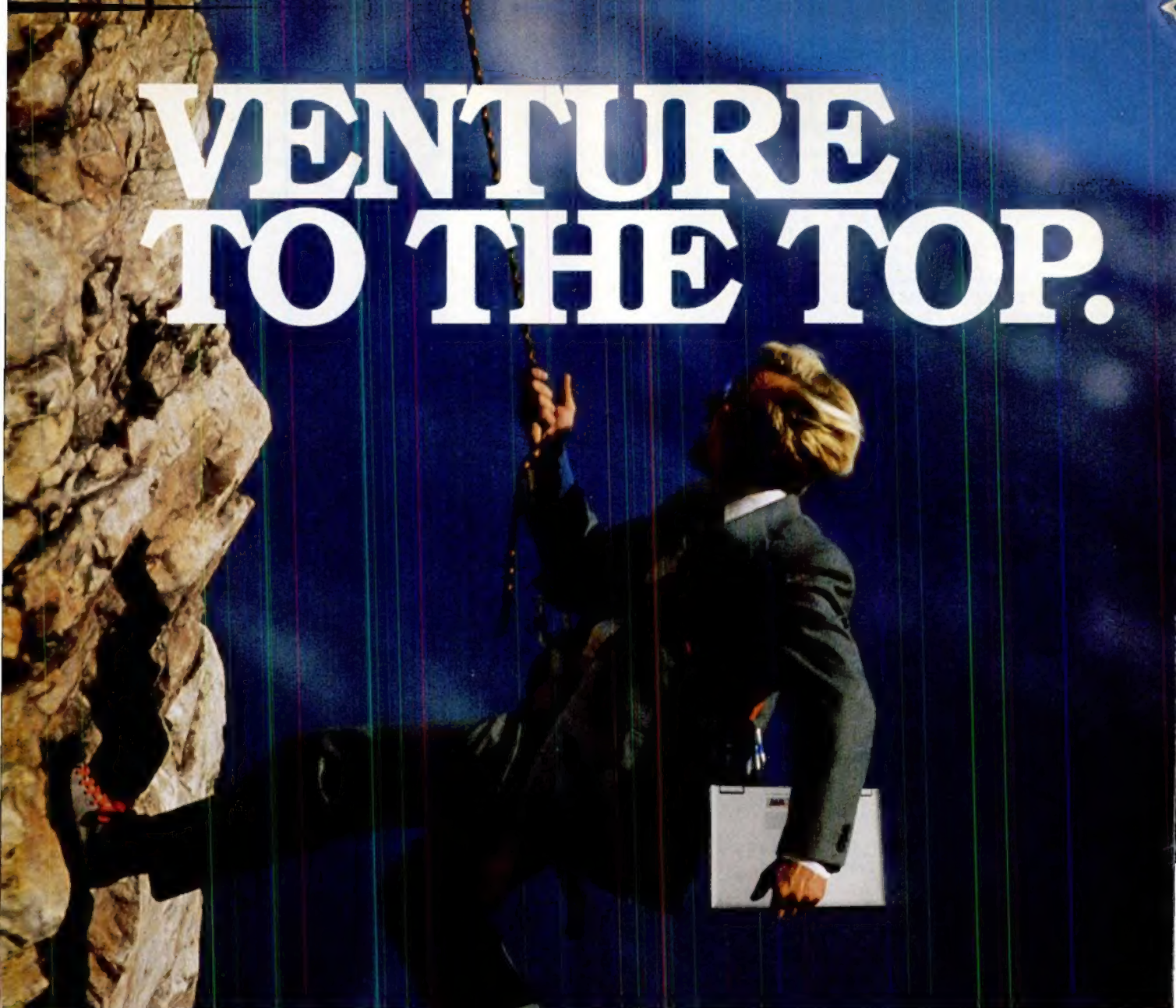
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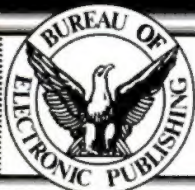
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Inside

Have you upgraded to DOS 5.0? If you haven't yet, do you plan to?

While it may be an easy decision for you as a single user to head down to your local software store and pay \$40 or \$50 for the DOS 5.0 upgrade, it's a more difficult question if you're responsible for 100, 1,000, or 10,000 systems. Is upgrading to DOS 5.0 really worth that kind of investment of time and money?

Contributing editor Jeff Prorise says yes and tells you just why in this issue's feature story, "DOS 5: What's in It for You?"

Prorise, a five-year contributor to *PC Magazine*, is well equipped to analyze what's hot and what's not in DOS 5.0. He has spent countless hours over the past few years writing more than two dozen DOS utilities for *PC Magazine*'s Productivity section. After all, throughout its ten-year history, DOS has had plenty of gaps to fill.

Those utilities, most of which are available for you to download directly from PC MagNet, include CARDFILE and the command-line enhancer DOSKEY, which has actually been rendered obsolete by the DOSKEY command that has shown up (finally) in DOS 5.0.

Prorise is also the author of *DOS 5 Techniques and Utilities*, which was recently published by Ziff-Davis Press, and for close to two years he has been



answering your questions in *PC Magazine*'s Tutor column. In fact, this issue's Tutor includes detailed advice on taking advantage of DOS 5.0's memory management tricks, and last issue's column focused on the DOSKEY command. Prorise will be covering more aspects of DOS 5.0 in future Tutor columns, and he looks forward to answering all your DOS 5.0 questions.

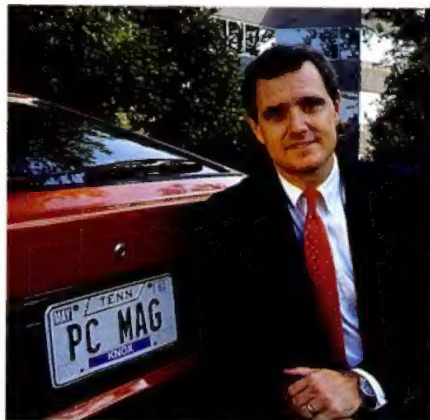
"It's hard to poke a lot of holes in DOS 5," Prorise says, "though I can't believe that the Shell's task switcher swaps programs out to disk rather than to extended or expanded memory. That makes it much slower than it should be."

He adds that "Just three years ago Microsoft was maintaining that DOS was a dead product,

but DOS 5 seems to prove that Microsoft's commitment is still real. In fact, one of the most exciting ways to look at DOS 5 is as a portent of things to come."

Prorise never has trouble expressing himself; his penchant for vanity license plates proves that. But if you sometimes find yourself at a loss for words, take a look at the 15 writer's tools we've also evaluated in this issue. The dictionaries, thesauruses, writing style guides, and grammar checkers they provide will help you find the perfect words every time.

—Don Willmott



In this issue, contributing editor Jeff Prorise takes you on a spin through the bevy of new features in DOS 5.0.

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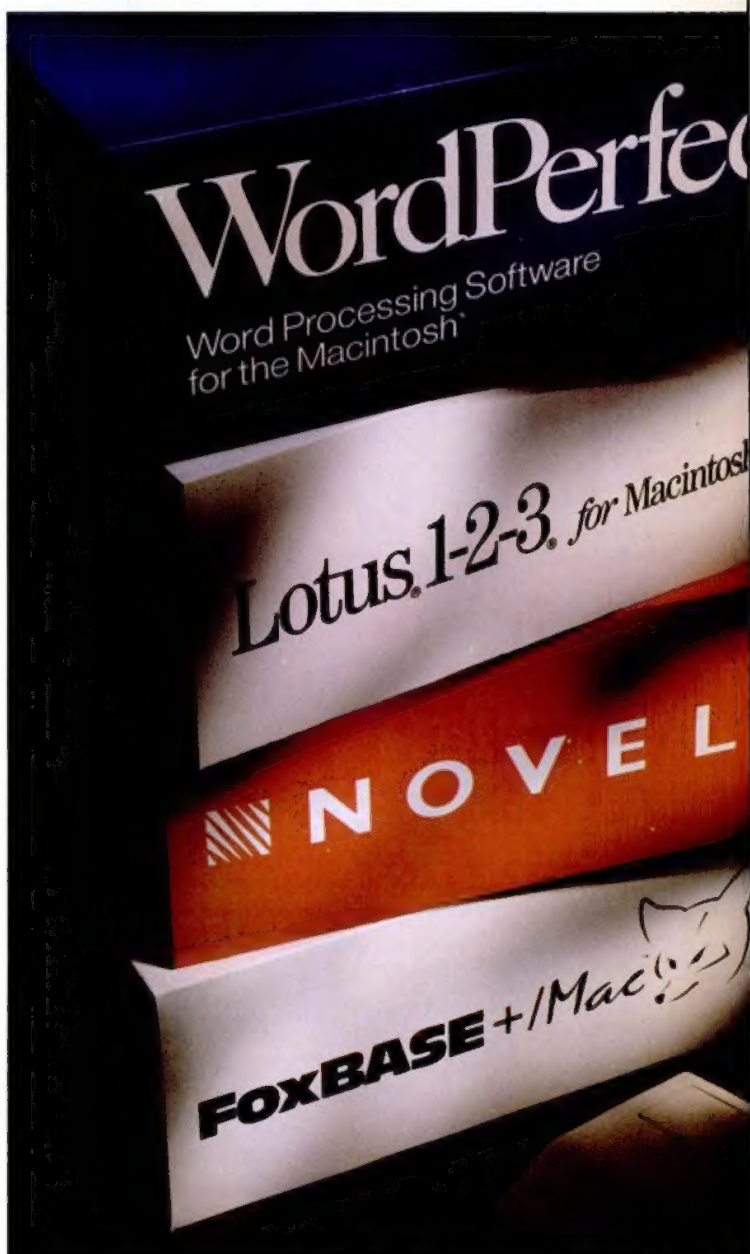
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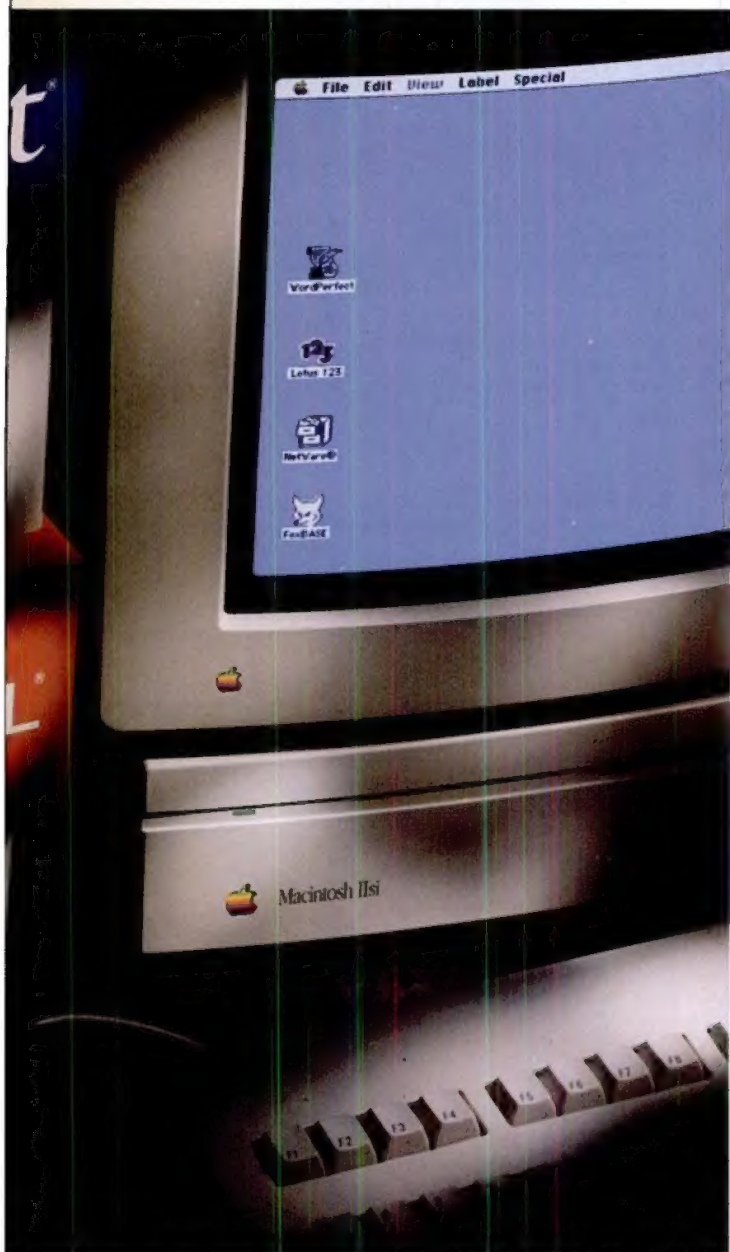
For example, a graphics and drawing package is built



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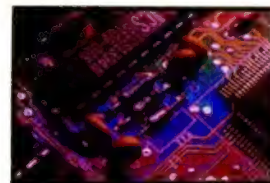
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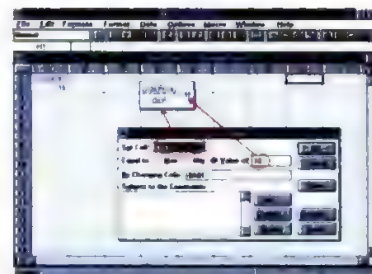
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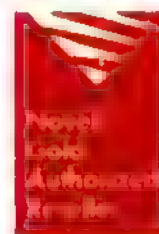
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■ DATABASE DILEMMA

I'd like to hear how Richard Hale Shaw's review of *Clarion Professional Developer* ("15 Relational Databases: Easy Access, Programming Power," May 28, 1991) aligns with *Clarion's* nomination in last year's *PC Magazine* Awards for Technical Excellence.

Paradox and *FoxPro* are both excellent database environments. But I chose *Clarion* for my application development precisely because I needed something more complete than either of those packages could offer as a professional development environment (including hardy and flexible database management facilities) for delivering compiled, complete applications.

David Kalman's well-written introduction states that "none of the packages can meet Codd's orthodox definition" of relationality. But then Shaw spends precious space hammering *Clarion* for its definition of NULL and proceeds to mislead readers. It reads as if you can't write an inventory program—or any serious number-crunching application—in *Clarion*. The OPT attribute he mentions that excludes "NULLs" is optional and has nothing to do with how the numbers are stored, only how the key in which it is used handles zeros.

Mark S. Burgess
San Diego, California

I have used *Clarion Professional Developer* for three years. Once I started using it, it took me six months to unlearn the bad habits that I had picked up from *Clipper* and *dBASE*. If all you're looking for is the automatic creation of data entry forms on-screen (that is, if you're a "casual user") then don't waste your money on *Clarion*. If you're a serious professional who is imprisoned by spaghetti code and dangerous file liaisons, try *Clarion*.

Benjamin Toso
Port Orchard, Washington

Throughout his statements, Shaw categorizes *Clarion* as a development package for the "casual user," which



Our May 28 cover story prompted many readers to write in.

contradicts both its name and its aim. Granted, with *Designer*, inexperienced users can create nice applications in a snap, but his tone presents *Clarion* as a package for the nonprofessional developer. *Designer*, as good as it is, cannot begin to take full advantage of the programming power of *Clarion's* rich language. And the language is one of *Clarion's* strongest points.

Anthony M. Kirk
Lovely, Kentucky



Clarion Professional Developer does make it easy to create applications that use a common interface, but so do *FoxPro* and *Paradox*, both of which require very little time to create applications. And neither of those two Editors' Choice recipients require hand-coded features to speed up processing—they're already very fast.

Clarion's integrated front end is largely a shell for loading and running the .EXEs that make up the system. Highly integrated? Sorry, no. As for designing, editing, debugging, creating, and cross-referencing, you can do that inside the

environments of the two Editors' Choice recipients. As for compiling and linking, the review praises *Clarion* for offering these features, which others have long promised, but not delivered.

Regarding Technical Excellence Awards, keep in mind that *FoxPro* was also nominated in 1990, albeit in a different category. Nominees are chosen for advancing the state of the art, and price and relative performance are less critical in that context than they are in Editors' Choice selections. —Richard Hale Shaw

Because of all the hype and glowing reviews, I purchased a copy of *Paradox* last year and spent many hours evaluating it and comparing it with *dBASE*. Even though I approached the evaluation with a bias toward *Paradox*, the facts are that *dBASE IV 1.1* is clearly a more complete, better balanced product than *Paradox*.

Your summary of features omitted capabilities that *dBASE* has (such as scrolling lookup tables), and your review failed to point out *dBASE's* clearly superior report and screen generator, which produces modifiable code.

John E. Hallmark
St. Louis, Missouri

■ BACKUP BLUNDERS

Barry Simon's sidebar "Backing Up with DOS" (June 11, 1991), incorrectly stated that "DOS versions prior to 4.0 don't allow format and backup in one operation." This isn't true: Version 3.3 allows you to back up files to a disk that has not been formatted.

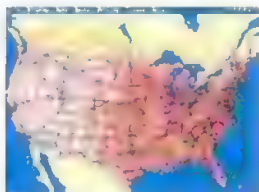
C.A. Quin
Washington, Illinois

Your article on backup software missed a very important test on all the packages for "real-life" application: compatibility with any other program that may also work with or have effect on DMA.

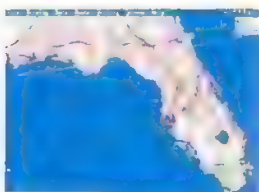
At this time, DOS provides the only backup program I'm aware of that is always compatible. I can't afford to pur-

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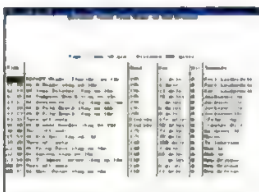
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Letters

chase the others to see if they get around DMA conflicts. Your report should have provided this critical information.

Darryl R. Dworkin
Oceanport, New Jersey

OS/2 WILL NEVER FLY

Bill Machrone's editorial on Microsoft's grand strategy (May 28, 1991) is long overdue. There was something suspiciously eager about the way you embraced OS/2 uncritically in its early days. Anyone who has experienced IBM's marketing tactics could have predicted that OS/2 would never fly.

Malcom Dean
Westwood, California

William F. Zachmann's almost religious zealotry for OS/2 has compromised his ability to analyze some very transparent survey results ("For Once, A Study Worth Studying," June 11, 1991).

Because the survey shows that Windows users list "memory management," "multitasking ability," and "uses extended memory" as the main reasons for purchasing Windows, Zachmann concludes that "fundamental conditions for the major success of OS/2 and PM are in place."

Zachmann should realize that OS/2 is IBM's Lisa. As Apple eventually followed the Lisa with the Mac, IBM may follow OS/2 with something truly wonderful.

Sal Cambareri
Stony Brook, New York

THE GEOWORKS FAN CLUB

I agree with David Moore's letter (June 25, 1991) about GeoWorks Ensemble. Ensemble is the best program I have ever seen. It's everything Windows could only dream of being.

I feel badly that this truly amazing program will never be given a chance, as IBM and Microsoft would never allow it. I hope that software developers will see Ensemble's amazing potential and begin developing it. Without third-party developers, Ensemble will never survive.

Josh Reznick
Brooklyn, New York

It is refreshing to see in the Letters column some recognition that the emperor (Windows) has no clothes, and that the pretender (Ensemble) is the rightful heir—if

he doesn't get assassinated first!

Sarah H. Knutti
Kennett Square, Pennsylvania

THE WINDOWS FAN CLUB

I'm getting tired of all those anti-Windows whiners (er, writers). Maybe you should require that those letter writers state what type of computer they use and whether or not they actually run Windows. I suspect that many of them wish they could run Windows but just don't own the hardware and are not willing to upgrade.

Jerome L. Tanski
Palm Harbor, Florida

Enough already! Windows is not all that bad. Of course it has faults, but so does all software. That's why there are upgrades!

Daniel J. Soeyadi
Hempstead, New York

WHITHER THE HOBBYIST?

I must take issue with John C. Dvorak's "Whither the Hobbyist?" column (June 11, 1991). While not many people these days are putting together their own PCs using a pile of chips and a soldering iron, the "home-brew" computer is still very much alive, but in a slightly different form. The basic building blocks are now motherboards, power supplies, and disk drives. True, this amounts more to assembling than building, but it still helps to have some of those hacker skills. Don't pronounce us dead yet! I can still feel a pulse.

Michael R. Kabala
Eldridge, Iowa

Looking back over the past nine years, I can truly say (to paraphrase Robert Fulghum) that all I really needed to know I learned on my TRS-80.

Pat Anderson
Fall City, Washington

MUMPS MANIA

In response to Dvorak's comment that businesses have little knowledge of MUMPS (Inside Track, May 28, 1991), MUMPS is actively presented at Robert Morris College.

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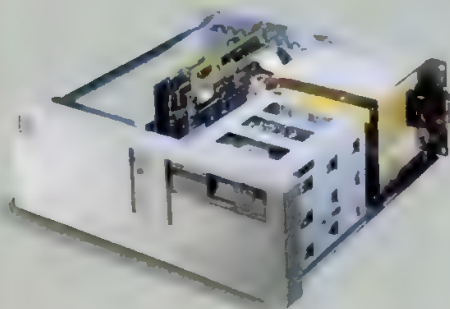
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Letters

CORRECTIONS & AMPLIFICATIONS

In the June 25, 1991, New and Improved column, the phone number for ATI Technologies should have read 416-756-0718.

In that same column, we should have stated that the *Magic Cursor* utility could be purchased as a standalone product for \$49.95.

In our review of gray-scale page scanners (August 1991 issue), we printed the output samples directly from

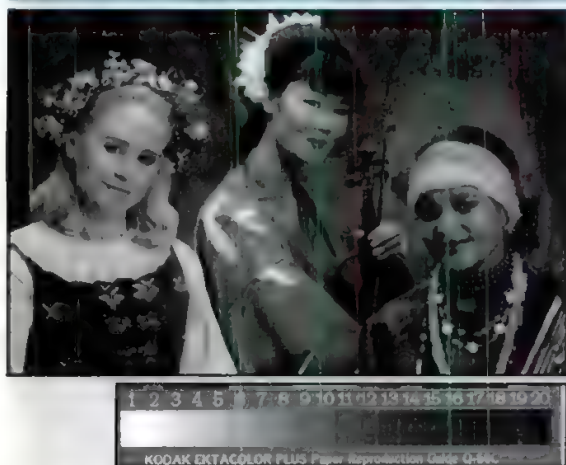
the film we used for our quality comparison. Because of restrictions in the printing process, however, they printed much darker than they appeared on film.

To give a better idea of the actual appearance of the output from our Editors' Choice, the HP ScanJet Plus, we have adjusted the original TIFF files to compensate for the errors introduced in printing. The images on top are what originally appeared in the magazine. The ones below are the corrected versions.

HP SCANJET PLUS (as originally printed)



HP SCANJET PLUS (as corrected to reflect true scan quality)

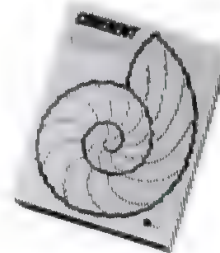


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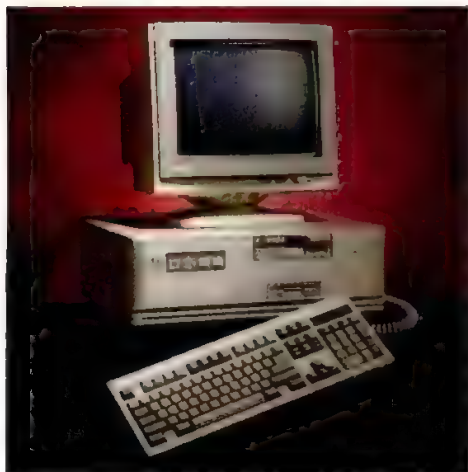
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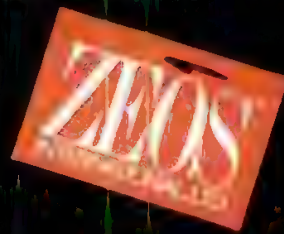
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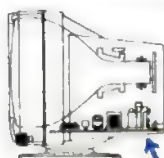
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by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

Mergers Promise Dramatic Changes For the Next Few Years

In past years, strategic alliances helped hardware and software makers gain the resources needed to compete with giants like IBM.

In 1991, the practice is different in several ways.

The merger has replaced the strategic alliance as the key to future growth.

And the giant is no longer IBM. It's Microsoft.

Borland Will Pump New Life into Both Paradox And dBASE

A couple of weeks after the shock of Borland's acquisition of Ashton-Tate was beginning to subside, officials from both companies finally revealed the direction the new company will take in the database market.

The new company's key goal is to keep *everyone* happy.

Both *Paradox* and *dBASE* will be upgraded, and the cross-platform strategies both products have been taking will continue. That means the SQL enhancements to both will continue and *Windows* versions of each will be introduced in coming months.

The synergy that the new company will bring to the products can be summed up in one word: objects.

A consistent object architecture will ensure what a Borland spokesman called, "a promiscuous database interoperability."

In one sense, the strategy is merely an enhancement of the same database engine strategy that Borland mapped out for *Paradox* years ago. The difference now is that Borland will be able to tailor Ashton-Tate

products to work within the model, too.

The object layer that will provide compatibility is a series of C++ classes that programs can call to access tables, reports, and queries in other databases.

The object architecture will allow programs to have embedded objects—a concept that incorporates Object Linking and Embedding (OLE), which Microsoft will build into *Windows* 3.1. Since these objects can access the database-requester features in the object layer, that takes the OLE concept a good bit farther than other *Windows* applications.

These plans revolve around the first graphical versions of each: *dBASE for Windows* and *Paradox for Windows*. No date has yet been established for shipping either product, but a Borland spokesperson said, "both are very pregnant."

dBASE for Windows should include a compiler that will generate standalone *Windows* or DOS programs. In addition, a separate *dBASE* language compiler may also be released.

To those familiar with Borland, it won't come as a surprise to hear that the company is already confidently promising to bring the concept to 32-bit OS/2 and *Windows*, plus whatever operating system the venture among IBM, Apple, and Patriot Partners produces.

The company is not endorsing every operating system in sight, however. There are plans for a *dBASE* standalone version as well as a SQL server to run under Unix and VMS. But the

rest of the product line is not necessarily going to make that leap.

The database strategy is quite clear and shows that the new company understands one fact loud and clear. Both the *dBASE* and *Paradox* product lines have built up loyal customer bases. Disappointing either would be suicide. Especially since Microsoft plans to introduce a database manager in 1992.

Other questions remain for the merged company. How will *MultiMate* and *Applause* evolve? Will *Quattro Pro* continue to have a powerful graphics engine, even if it means competing with *Applause*? Will the new company support the xBASE movement (the effort to make *dBASE* an open, public-domain language)?

Litigation with Fox Software is still pending, and until the merger is completed, neither Borland nor Ashton-Tate can comment on the last question.

Judging by the forthright way the new venture is starting out, when the new merger is completed, these questions are sure to be addressed very quickly.

Digital Research Gives Novell a Chance to Reach Inside the PC Operating Systems

Novell's acquisition of Digital Research is much less complicated than the Borland/Ashton-Tate situation.

Novell needs a way to determine its own future. Right now, Novell is at Microsoft's mercy; Microsoft has very clear ambitions for Novell's dominant share of the network operating system business.

Since Microsoft has said that future versions of DOS will have network connections built in (Pipeline, April 16, 1991), Novell is in a race against DOS 6.0's

release. The question buyers have a right to ask is which combination of server and client operating systems will run DOS applications best.

Now that *NetWare* 3.11 has demonstrated the ability to automate the backup of client PCs across a network, it's easy to see the potential benefits if Novell succeeds in giving network administrators remote control of a PC across a network.

Since Novell has shown it can deliver seamless DOS compatibility on a server, current Novell customers have every reason to believe that Novell can deliver this solution.

So the acquisition of Digital Research makes perfect sense. Building a DOS-compatible operating system from the ground up is far from a trivial task. Having that expertise within the company ensures Novell of a competitive response to the threat of all network-aware client-side operating systems.

While that work gets underway, Novell hopes to see Digital Research's multiuser and single-user DR DOS business grow, with help from Novell's sales force. And it hopes to use some of the graphical software development that went into *GEM* and *Artline* used in creating new *NetWare* software.

Meanwhile, Microsoft has several hundred programmers working on *Windows NT*, the 32-bit operating system that will be both a server and a client-side operating system. And one of these engineers is the man who helped make Banyan's *VINES* so good at linking diverse hardware platforms.

Microsoft is now saying that *Windows NT* will be publicly unveiled within a year.

Novell is not yet willing to talk about release dates.

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Pipeline

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PC Magazine Labs Begins Working with ZD Labs and BAPC

For years, PC Magazine Labs has gone it alone, creating tests and scripts for rating the performance of PC products. Recently, it's made two key alliances with new testing organizations.

The first is with Ziff-Davis (ZD) Labs, a new venture by *PC Magazine's* parent, Ziff-Davis Publishing Co.

ZD Labs will expand the testing available for *PC Magazine* to include multiplatform environments. ZD Labs is in the process of building a large facility in Foster City, California that will house Macs, workstations, wide area networks, and connections with mini- and main-frame systems.

One of ZD Labs' goals is to help ensure consistency among test results for all of Ziff-Davis' publications, including *PC Week*, *PC/Computing* and *MacUser*.

The results of this collaboration should start appearing within *PC Magazine* product tests early next year.

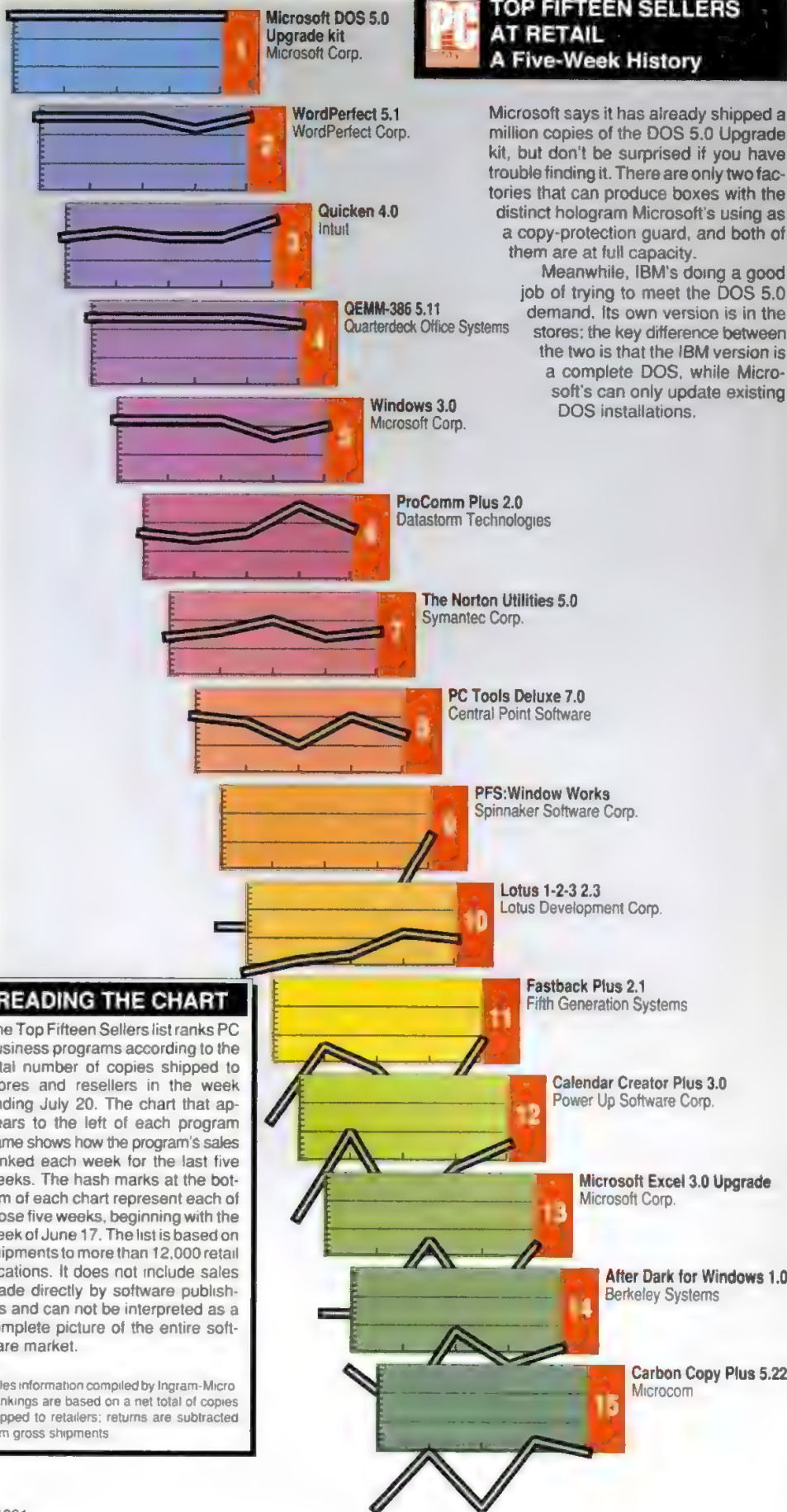
The other alliance is with Business Applications Performance Corp. (BAPC), a consortium of PC manufacturers who are putting aside their competitive differences in the interest of building reliable benchmark tests for PCs.

BAPC plans to use off-the-shelf applications software in creating these tests, a practice that most vendors use in their own research labs.

This is a different approach than *PC Magazine* has taken over the years; PC Labs has created very specific tests in C, assembler, and BASIC to directly address the hardware, generating results that tell us whether a unit conforms to spec and how well it performs in a very specific task.

As a member of BAPC, PC Magazine Labs will share its experiences in testing.

The founding companies are Dell, IBM, Intel, and NCR; the group is encouraging other manufacturers to join.



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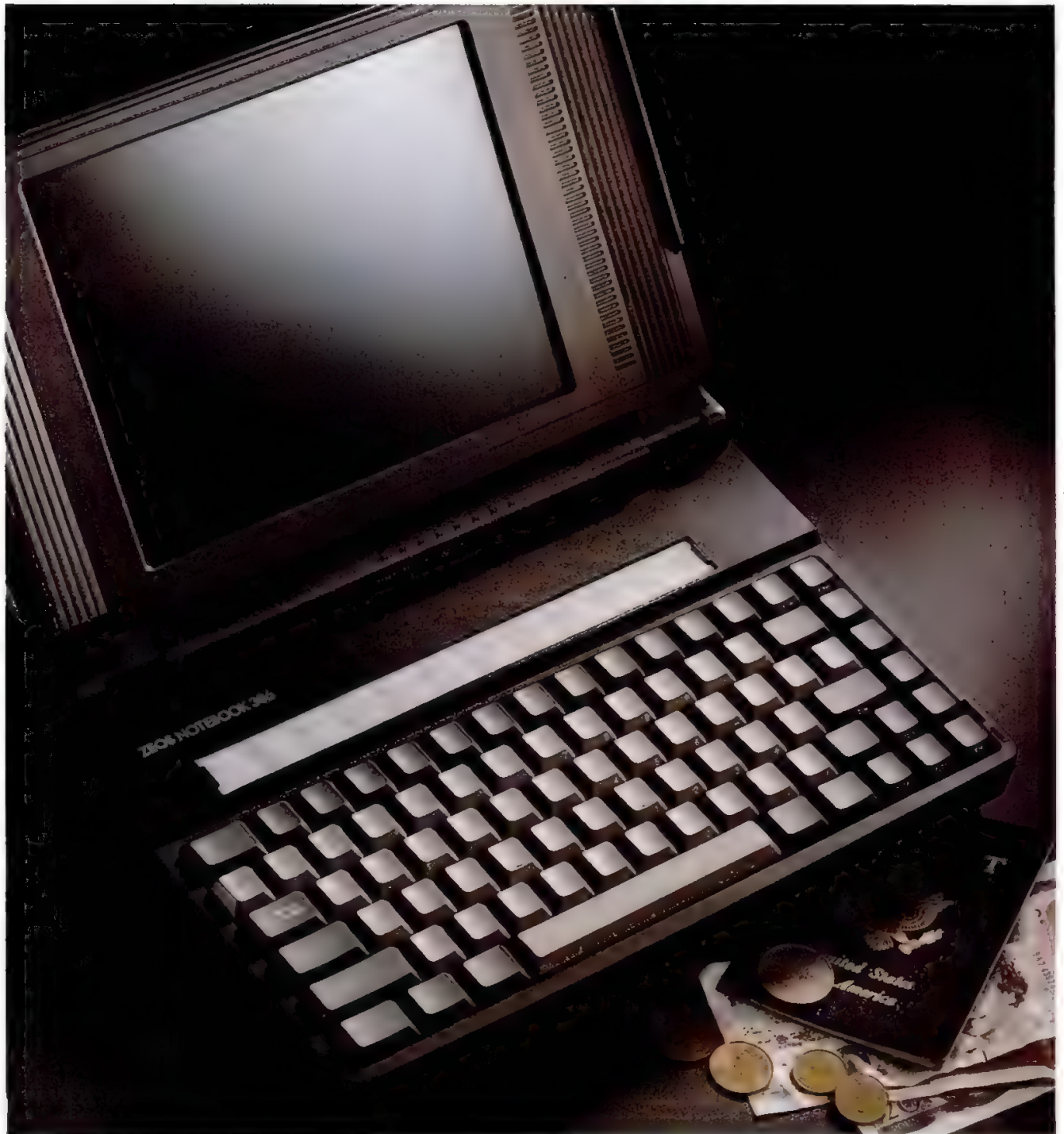
- PC Magazine, *"There's a new king of the hill—the ZEOS Notebook..."* Editor's Choice.
- PC World, *"ZEOS' Notebook 386 earns a Best Buy thanks to a low price, fine support, and a solid set of features...it's the one to buy..."* Best Buy.
- John C. Dvorak, *"In this category I'm most impressed with the ZEOS Notebook...it has to be the number one contender."*
- PC LapTop, *"The notebook you've been waiting for."*
- Infoworld, *"This notebook is a steal."*
- PC Week, *"An outstanding value."*
- Mobile Office, *"The best price performer in its category."*
- Byte, *"The ZEOS Notebook...a clear winner...why settle for less?"*
- Portable Office, *"The ZEOS Notebook...delivers astonishing value...sensational."*
- PC Computing, *"The ZEOS beats the Compaq."*
- Lotus, *"The ZEOS has it all—power, support, good looks."*
- Computer Shopper, *"The ZEOS Notebook...it's the hottest...an excellent value."*

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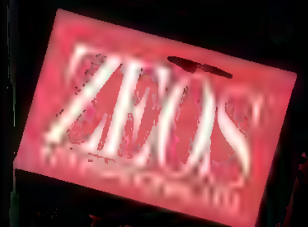
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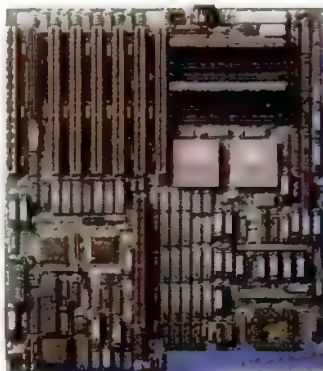
By now, you've probably heard about our industry-first 4860™ MotherBoard that packs the power of the Intel 80486 CPU with the Intel 80860 RISC processor (i486™ + i860 = 4860).

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First Looks

Hands-on Reviews of the Latest Products

Windows Will Never Be the Same

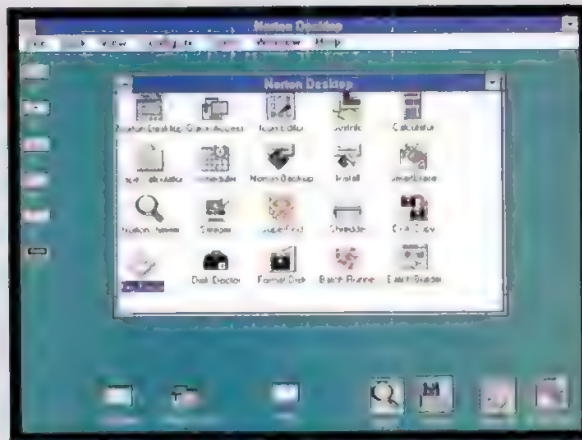
\$149 Norton Desktop for Windows Changes the Face Of File Manager and Program Manager with 20 Utilities

by Barry Simon

The Windows desktop utility landscape will never be the same. Symantec Corp.'s *The Norton Desktop for Windows* (NDW) is an amazing collection of just about all the general-purpose utilities you could ever want for *Microsoft Windows*, with the only exceptions a calendar and a phone dialer. With a price of \$149, Symantec is very serious about making this program the leading Windows utility package.

Included in the package are replacements for *Windows* File Manager and Program Manager, as well as *The Norton Backup for Windows*, numerous file viewers, a full-fledged batch language, and several programs from *The Norton DOS Utilities* that handle disaster recovery.

NDW's slick installation uses a new program from the Sterling Group (708-307-9197) that you'll probably see in other



The Norton Desktop for Windows combines the features in the Windows Program Manager and File Manager. When you click on a drive icon, it will display a directory and list the files. In addition, 20 utilities are provided for system backup, undelete, and text searches.

Windows programs.

When you run the main *Norton Desktop for Windows* program, your old Windows desktop takes on a brand new face.

There's more color, more icons, and a more graphical (okay, more Mac-like) way of working with Windows files.

The centerpiece of this col-

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lection is called Norton Desktop. It cooperates with a second utility called Quick Access to provide a rich integrated environment for manipulating files and running applications.

Norton Desktop will put to rest any complaints you have about ProgMan and FileMan, and still goes far beyond what you'd expect. Quick Access groups look like ProgMan groups, but Quick Access performs as if it has had a shot of steroids.

CONTINUES ON PAGE 36

50-MHz 486 Debuts in Dell PowerLine File Server

**HANDS ON
by Patrick Honan**

Dell Computer Corp.'s PowerLine 450SE is the first computer to reach PC Magazine Labs with Intel's new 50-MHz 486 processor. The PowerLine 450SE may be ahead of the pack for pure speed, but it stays in line with today's prevailing trends for high-end machines.

The PowerLine family of file servers uses an upgradable

CPU design. You can select the 20-MHz 486SX-based 420SE or 33-MHz 486-based 433SE and then upgrade to the faster 50-MHz 486-based processor later. Dell uses a passive motherboard design; this means that the CPU, Dell's own cache controller, and cache memory are on a 32-bit daughtercard that plugs into a dedicated slot on the motherboard.

Dell complements the fast

CONTINUES ON PAGE 37



Dell has combined top performance with rugged construction, generous expansion, and ergonomic design in its 50-MHz 486 PowerLine 450SE.

PHOTOGRAPHY: THOM O'CONNOR

First Looks

Norton

CONTINUED FROM PAGE 35

You can also do all sorts of things with groups that you couldn't do before. A group can remain on the desktop whether or not the main launch window is open. You can place subgroups within groups. Each launch item can have a unique startup directory; they are not confined to starting from the program's directory.

Included in the program is a special startup group. All you need to do to launch a program on startup is to drag an icon to the startup icon; no need to modify your WIN.INI file to add a LOAD or RUN command.

If you don't care much for the "ProgMan as launcher" metaphor, Norton gives you alternatives. You can use a menu bar that Norton Desktop places at the top of the screen, customizing it to accommodate your own programs, even setting up your own submenus.

Or you can use the control menu that Norton Desktop alters to include three additional items. One of these gives a submenu of running tasks. Another invokes a menu of applications that you set up by calling the last of these extra items, a module called the Launch Manager.

Finally, any applications that you set up in Quick Access

or from the Launch Manager can have hotkeys associated with them, giving you another way to launch a program.

As you would expect from a Peter Norton product, file management is deftly handled. By default, the left column of the desktop contains icons for each of your disk drives. Double-clicking on a drive icon opens a pop-up window that displays a directory tree on the left and a file list linked to the chosen directory on the right. Multiple drives or multiple views of a single drive can be opened simultaneously. An additional window can be opened to view a highlighted file.

Copying and moving files is as easy as dragging icons from one file window to another. If you prefer, you can select a copy or move button, and pick the destination from a dialog. There are also on-screen buttons to delete files, or you can call the Superfind module.

Norton Viewer, the file-viewing engine, and Superfind, the file- and text-search utility, are linked to the drive windows; they also can be run standalone.

Included in the package are viewers for the leading word processors, spreadsheets, and databases. You can view the directories of .ZIP, .ARC, and .LHA files, but you cannot view the contents of these files the way you can with Lotus's *Magellan*. Graphics viewers include .BMP, .ICO, .PCX, .GIF, .TIFF, but not CGM or



NORTON THROWS IN EVERYTHING BUT THE KITCHEN SINK

In the DOS world, *The Norton Utilities* serves up a "can't-live-without-'em" slew of tools for fixing disk problems. Symantec Corp. complements this collection with additional products for file backup (*The Norton Backup*) and simple file management (*The Norton Commander*).

In making the transition to *Windows*, Symantec is taking the same Swiss Army knife strategy that its archival, Central Point Software, took with *PC Tools Deluxe*. *The Norton Desktop for Windows* combines most of the features in *The Norton Utilities*, *The Norton Commander*, and *The Norton Backup*.

Here's what you get in *The Norton Desktop for Windows*:

- Norton Desktop: copies, moves, and deletes files; launches programs.
- Quick Access: launches programs.
- Icon Editor: creates and manages icons.
- SysInfo: provides comprehensive system reporting.
- Calculators: includes a conventional calculator (with on-screen "tape") and a scientific calculator.
- Scheduler: sets alarms and enables unattended program launching.
- Smart Erase: retains files for a user-specified period after deletion.
- Norton Viewer: contains file viewers for text, .EXE, *Microsoft Word*, *WordPerfect*, *Lotus 1-2-3*, *Microsoft Excel*, dBASE, .BMP, .GIF, .PCX, .ZIP, .ARC, .LHA, .ICO, and TIFF.
- Sleeper: blanks screen with a choice of 13 graphics displays.
- Superfind: has file finder and text search functions.
- Shredder: provides a file wipe utility.
- DiskCopy: makes an identical copy of a disk.
- Keyfinder: picks font displays and characters.
- Windows Disk Doctor: diagnoses disk problems outside *Windows*.
- Format Disk: formats floppy disks.
- Batch Builder: creates Norton batch files.
- Batch Runner: provides a *Windows* batch language.
- DOS Disk Doctor: diagnoses and corrects DOS-level disk problems.
- SpeedDisk: defragments disks.
- Unformat: recovers an entire hard disk.
- Unerase: unerases DOS files.

.WMF. Norton Viewer supports the *Windows* multiple document interface (MDI) so you can view multiple files simultaneously in separate subwindows.

Icons are another example of

how *NDW* takes up where *Windows* left off. You can drag any icon out of a Quick Access window, or any file out of a drive window, and place it on your desktop where it is portrayed as an icon on a raised gray background. Double-clicking on these icons launches their associated programs.

In addition, Shredder (the equivalent of Norton's DOS-based Wipe utility), Smart Erase (the equivalent of the Macintosh trash can), Norton Viewer, a backup utility, and a print tool can each be optionally placed in a framed icon, creating something of an object-oriented environment.

Double-clicking on the print tool, for example, invokes the *Windows* printer dialog box. Dragging a file to the print tool prints the file. If the file is associated with an application, then Norton Desktop launches the program with the filename as a parameter and sends Alt-F-P

NORTON'S NEW BATCH LANGUAGE

Much of the power in *The Norton Desktop for Windows* comes from its powerful batch language.

You can use the language to do things like launch applications, and then move, minimize, maximize, or hide windows. You can change the displayed title of any main window, get input from a simple text box or from a dialog box.

A simple editor, Batch Builder, lets you create the

scripts, and will pop up a list of the language's 100-plus commands and their syntax.

The batch language is bare bones: There are "if-then" and "GOTO" constructs, but no "Else," "Case," or "For" loops. However, with the language's arithmetic abilities, you can roll your own.

There are strings and integers but no arrays, and there is a single-step debug mode. *NDW*'s batch lan-

guage doesn't have the elegance of Softbridge's *Bridge Batch for Windows*. That language has a WYSIWYG dialog box maker, as well as DDE support, arrays, and structured language.

Wilson Windowware's \$70 shareware program *Winbatch* is identical to *NDW*'s batch language, and *Winbatch* includes a macro program that's not available in *The Norton Desktop For Windows*.—BS

keystrokes to the application to start printing. Similarly, you can act on a file by dragging it to the Shredder or Viewer.

Windows is the ideal backup environment since it allows you to perform backups in the background, and *NDW* takes full advantage of the situation. The package includes a full-featured *Windows*-based backup program and a scheduler which, for example, allows you to configure your system to do a daily backup at a preset time. The backup program lets you choose files from a dual window tree and file dialog. You can save backup configurations and file choices for more automated backups.

The backup program performed with speed and grace. It handled the curve balls we threw at it, such as inserting a 360K floppy disk in the middle of a 1.2MB backup.

The desktop also includes the disk disaster protection that you've come to associate with *Norton*. By loading Smart Erase as a TSR, you can store erased files in a separate directory until you explicitly purge them, or until a specified time has passed. A more standard Unerase program is provided, too.

NDW runs Disk Doctor, but only as a diagnostic tool. However, DOS-based Disk Doctor, which does the fixing, is included in this package. Also borrowed from *The Norton Utilities* are an Unformat program, a DOS-level Unerase, and a defrager.

Scattered throughout the modules are thoughtful little extras. For example, there's a sales tax button built into the calculator. There are improvements to the way in which *Windows* searches file list boxes, too. Instead of being relegated

to typing only the first letter of a file, you get a pop-up box that allows you to type as much information as you need.

And just to make sure this is a total solution for *Windows*, Symantec has added the small touches, like an icon editor and a screen-saver with password protection.

I can't imagine any *Windows* user who won't want to own this magnificent, cost-effective collection.

Whether you are a power user who wants more out of *Windows*, or a novice who originally shied away from some of *Windows*' idiosyncrasies, you'll find something in *NDW* to make your life easier. There's a good chance that you'll find *The Norton Desktop for Windows* provides the most profound changes in the *Windows* environment since the introduction of *Windows* 3.0 itself. ■



FACT FILE

The Norton Desktop For Windows, Version 1.0

Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014; 408-253-9600.

List Price: \$149.

Requires: 286-based PC or better, 1MB of RAM (3MB recommended), 4MB hard disk space, DOS 3.1 or later, *Windows* 3.0 or later.

In Short: *Norton* comes to *Windows* with a profound effect. A collection of utilities that will change the way *Windows* users think about *Windows*. Some of the functions provided are program launching, file management, backup, screen blanking, system information, and emergency disk recovery. There are also two calculators, a batch language, and a key finder.

CIRCLE 705 ON READER SERVICE CARD

Dell 50-MHz 486

CONTINUED FROM PAGE 35

processing speed with an EISA bus, generous expansion, and intelligent internal design, making the PowerLine 450SE a solid choice as a network file server for those not seeking a multi-processor-based system.

All the models in Dell's PowerLine SE line come in the same 24- by 7.6- by 22.2-inch (HWD) tower case and use the EISA bus. (Dell offers the PowerLine DE series, a desktop version that has less expansion potential. The PowerLine DE offers five drive bays, three of which accept removable media. It also features six EISA expansion slots.)

Pricing for the 450SE is reasonable when you consider that the 50-MHz chip is brand new. The tested machine costs \$12,327, including 8MB of RAM, a Super VGA display subsystem, both 1.2MB and 1.44MB floppy disk drives, a 330MB hard disk with a 32-bit EISA controller, and Microsoft's new DOS 5.0.

For those looking to grow into a 50-MHz 486 file server, a PowerLine 420SE (20-MHz 486SX) with 4MB of RAM, Super VGA, one floppy disk, and an 80MB IDE hard disk costs

\$5,399. Upgrading the CPU daughterboard costs \$2,599 (from a 20-MHz 486SX to a 33-MHz 486), \$4,999 (from a 486SX to a 50-MHz 486 board), and \$3,299 (from a 33-MHz to a 50-MHz 486). The upgrade includes an allowance for trading in the daughterboard.

Like Intel's other 486 processors, the 50-MHz chip has an internal 8K RAM cache. To that Dell adds a 128K cache controller of its own design, eschewing Intel's CPU daughtercard, the 50-MHz Intel 486DX CPU-Cache. (See "The 50-MHz 486 is Just One of Several New Processors Intel Is Planning" for

more information on Intel's 486DX CPU-Cache.)

Intel's CPU-Cache features a 256K cache controller, but a Dell spokesman told us that the Intel cache design would add hundreds of dollars to the price with a negligible speed improvement in the disk-intensive server applications the 450SE is designed to handle. The Intel design is better suited for multi-processor systems, while Dell's own direct map write-through cache has been optimized for the PowerLine 450SE.

The reviewed unit has a 32-bit EISA hard disk controller from UltraStor equipped with

4MB of cached memory. Dell also offers its Dell Drive Array (DDA). Priced at \$1,999, this 32-bit EISA controller supports up to ten IDE hard disks and has an Intel 960 RISC chip that handles I/O processing. Network administrators can configure DDA in several ways for the backup and restoration of data, should one or more of the hard disks fail.

The faster performance of the 50-MHz 486 chip was clear in PC Magazine Labs' processor tests. The 450SE runs our 486 Instruction Mix benchmark test in roughly two-thirds the time of the Compaq Systempro

THE 50-MHZ 486 IS JUST ONE OF SEVERAL NEW PROCESSORS INTEL IS PLANNING

by Robin Raskin

Besides being 50 percent faster than the 33-MHz version, Intel's new 50-MHz 486DX microprocessor differs from its 33-MHz predecessor in two ways: in its manufacturing process and its packaging.

Instead of the 33-MHz's 1 micron, two-layer metal

CHMOS-IV process, the new 50-MHz 80486 chip uses a 0.8 micron, three-layer CHMOS-V metal process. The extra layer lets Intel cut the vertical size of the chip to about half the size of the 33 MHz.

Intel has demonstrated a 100-MHz 486DX chip that uses the same fabrication

process, and has discussed plans for the next-generation 586 chip (code-named P5), a 3-million transistor chip with superscalar RISC features, which will run at speeds greater than 100 mips (million instructions per second). The first of these P5 chips is expected to reach

CONTINUES ON PAGE 38

equipped with a single 33-MHz 486 processor. The PowerLine 450SE also scores well on the small- and large-record DOS File Access benchmark tests, and on the BIOS Disk Seek benchmark tests, but these tests reflect performance on a stand-alone system rather than a file server and do not indicate the full difference a 32-bit EISA controller will make in certain networking situations.

Dell's PowerLine SE family offers plenty of room for expansion. The 450SE has eleven half-height drive bays, five of which accept removable media. There are eight EISA slots; seven are open, since the video, serial, and parallel ports reside on a proprietary daughtercard.

The standard 300-watt power supply is enough for most configurations, but you'll need an additional 55-watt power supply (\$99) for systems with more than four 650MB hard disks or eight smaller-capacity hard disks. You can add memory in the eight SIMM sockets located on the system board; maximum system memory is 128MB (achieved by using eight 16MB memory modules).

The PowerLine 450SE also features a proprietary firmware subsystem that uses Intel Flash memory to store the system BIOS. In the future, users will be able to upgrade system BIOS by installing a new file from a floppy disk.

Aside from its solid technological features, the PowerLine 450SE has some of the best ergonomic elements in personal computer design since IBM came out with the PS/2. The PowerLine's shipping cart opens to become an unloading ramp. The unit is on wheels and has a convenient handle on the front. Ports are along the top of the computer rather than the rear, making it easier to connect cables. Finally, there are no screws to unfasten to get inside the machine. The case's right side simply snaps off with a few strong tugs at the corners.

The PowerLine 450SE comes with a one-year parts-and-labor warranty, on-site service from Xerox, and toll-free technical support Monday through Saturday.

Intel Planning News Processors (CONTINUED)

system designers by mid 1992.

Intel has also announced, and is close to delivering, a family of processors that will operate twice as fast internally as they do externally. Initially these products will be available as 486SX processors (that is, without an internal math coprocessor), although Intel may bring the concept to other processors.

These new processors (sometimes called "dual clock") will double performance by executing two instructions per clock cycle. While earlier Intel processors required several clock cycles to execute a single instruction, the 486 executes an instruction with every clock cycle. When a processor can execute two instructions per cycle, it has effectively doubled performance for that clock speed.

These 40/20-MHz, 50/25-MHz and 66/33-MHz

processors (internal/external) free designers from having to redesign circuit boards to accommodate a speedier generation of chips. And they allow higher performance at relatively lower clock frequencies to reduce the radio emission problems that hamper the design of systems with clock frequencies above 33 MHz.

All of the chips in the 486 microprocessor family have an 8K primary internal cache, but at 50 MHz and beyond, it will become important to reduce the imbalance between processor and memory speeds. To this end, Intel created the 50-MHz Intel 486DX CPU-Cache module to help reduce traffic on the memory bus. Effectively, the cache controller monitors or "snoops on" the bus to see if the data that is being written to memory is in the cache. If so, it purges the existing cache data to keep the contents of the cache coherent

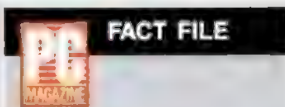
with system memory.

Intel's CPU-Cache includes a cache controller and nine 32K dual-ported SRAM buffers and registers (one for parity and 256K for data). The cache module can run synchronously or asynchronously with the rest of the system so that the CPU and local memory can access the cache concurrently.

The Dell PowerLine reviewed here uses its own proprietary cache, in part because it's less expensive, and in part because the Intel CPU-Cache's design is strongest in multiprocessing environments; the Dell PowerLine has a single CPU.

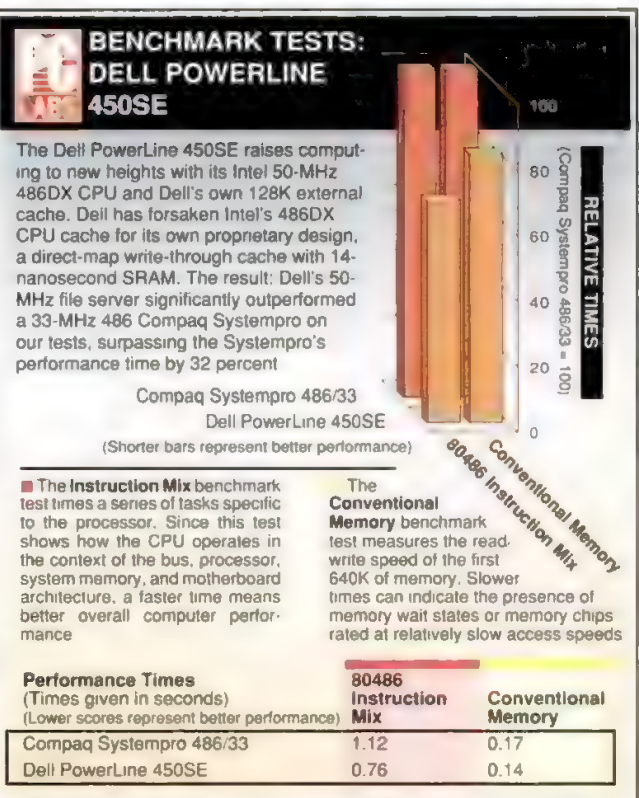
Intel's real goal is to help beat the RISC chip threat by tailoring future processors to meet specific needs. The result should be continued compatibility between desktop PCs and servers, with a greater number of choices at each level. ■

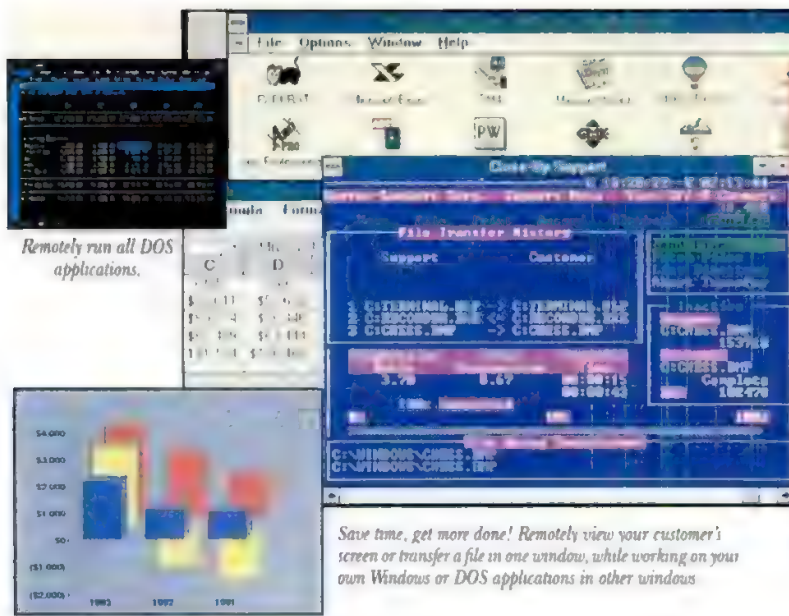
Dell Computer Corp. has been on a hot streak lately, winning a larger market share as it debuts one solid machine after another. With the PowerLine 450SE's CPU speed, the I/O capabilities of the EISA bus, and the solid expansion options, Dell rolls another seven. ■



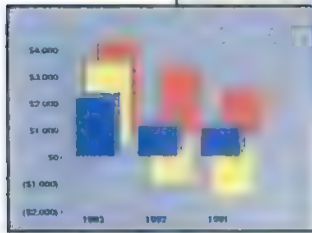
Dell PowerLine 450SE
Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759-7299; 800-289-3355, 512-338-4400.
List Price: With 8MB RAM, 330MB hard disk with the 32-bit EISA controller, 1.2MB and 1.44MB floppy disk drives, Super VGA display subsystem, DOS 5.0, \$12,327.
In Short: While the Dell PowerLine 450SE features Intel's fastest processor to date, its thoughtful all-around design makes it a worthy file server for any network.

CIRCLE 704 ON READER SERVICE CARD

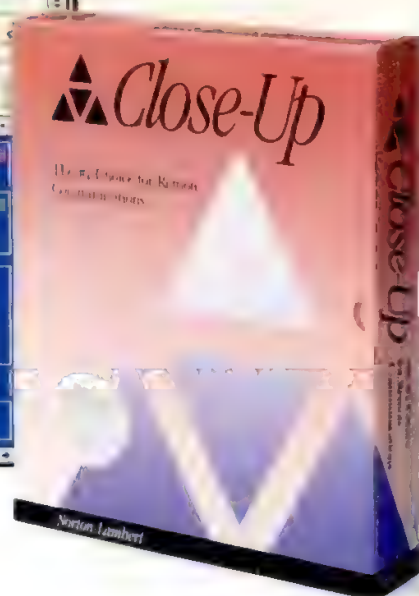




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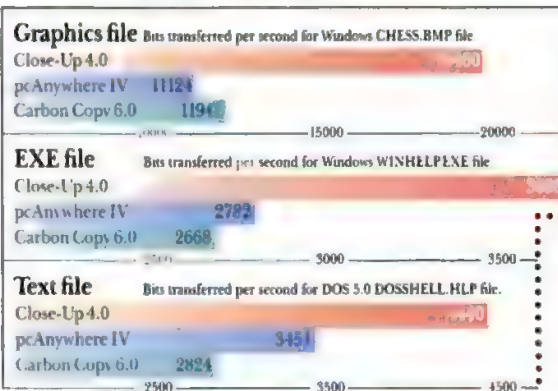
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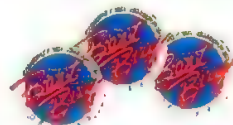
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First Looks

dBASE SQL Server Suffers From a Split Personality



With the news of Borland's merger with Ashton-Tate, it's expected that many questions will be raised about the future of the dBASE language (for some of the answers, see Pipeline, page 29).

With the release of dBASE IV Server Edition, however, Ashton-Tate is delivering on a commitment it made several years ago to bring the language to SQL Server.

The name *Server Edition* is somewhat misleading, as this dBASE release is designed to let you access data on the *Microsoft/Sybase SQL Server* from within dBASE; it does not provide any database server functions of its own. The basic package can be installed standalone or on a LAN, allowing three simultaneous users to access either shared dBASE files or SQL Server files.

When we last looked at dBASE IV ("15 Relational Databases, Easy Access, Programming Power," May 28, 1991), we complained about the implementation of its SQL interface. The SQL module in the *Server*

Edition is vastly improved—but now it almost seems like an entirely separate product. When dBASE is in SQL mode, many of the dBASE functions are either disabled or change their behavior.

Here's how the *Server Edition* works: SQL commands are used to retrieve the data, and dBASE commands are used to process and format it for the screen or printing. dBASE's built-in SQL commands can still be used to access dBASE data and index files, though the DBDEFINE command must first be run against them to store the appropriate information in the SQL catalogs.

But once dBASE is in SQL mode, and the database being accessed resides on the SQL server, any dBASE commands that make physical changes to the database itself are disabled. For example, the SQL commands CREATE TABLE and ALTER TABLE are used to define or change the structure of the database tables, replacing the dBASE CREATE/MODIFY STRUCTURE; CREATE INDEX is used instead of INDEX ON to establish indexes.

An additional parameter for

the SQL SELECT command lets the results of a query on the SQL server be saved in a local .DBF file.

When SQL commands are run against local .DBF files, the commands are internally translated to dBASE commands before being processed. However, when the SQL commands are issued against a SQL Server database, dBASE either passes them on directly, or translates them to the appropriate TRANSACT-SQL (SQL Server's native language) commands. Because of this, transactions against a SQL Server database usually execute faster than they do against a local database containing the same data.

You switch between dBASE and SQL modes interactively. SQL program files are distinguished from regular dBASE programs by using a .PRS instead of .PRG file extension. SQL programs and dBASE programs can be intermixed in the same application, by chaining to the different program modules. SQL programs can also use what is called "dynamic SQL." These are commands that are a subset of the dBASE SQL statements, and are constructed and executed when the application is run.

Standard dBASE commands are used to query the application's user for input, and then pass the input to SQL commands through memory variables. This is a powerful feature that allows developers to design ad-hoc queries into the application.

Unlike standard dBASE IV, the *Server Edition* includes the DOS/16M Extender, giving it access to extended memory to store and run application code. In fact, it requires at least 1MB of extended memory to run, though its low RAM (RAM below 640K) requirements are reduced to needing only 60K free.

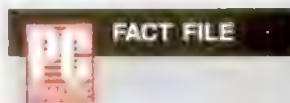
The external DBSETUP program used to configure dBASE has an additional option that controls the behavior of the DOS/16M, including the amounts of memory it can use, and where its swap file should be located. These settings can have a noticeable impact on performance, so the developer or

LAN administrator should use this utility to fine-tune the *Server Edition* when creating applications.

The installation process is the same as that of the regular dBASE IV 1.1 package. However, one bug has crept in; if the included HyperDisk cache (DBCACHE) is enabled during the installation process, the process will randomly fail at some later point while unpacking the files. When this happens, the entire 14-disk installation must be started from the beginning.

The installation program also copies a README.DOC file to the hard disk that contains important update information, and should be read before using the product for the first time.

The dBASE IV *Server Edition* is a useful front end for SQL Server; programmers familiar with the dBASE programming language will find it easy to extend their applications to the client/server architecture. Compared with *Paradox SQL Link* or *DataEase SQL*, though, it's not as tightly integrated into the system as it could be, and users may find its schizophrenic nature confusing.



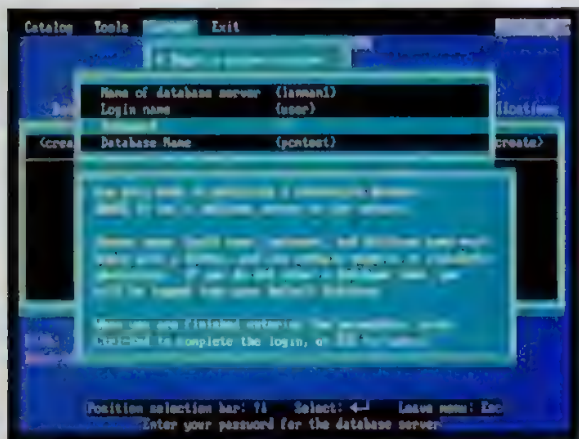
dBASE IV Server Edition, Version 1.1
Ashton-Tate, 20101 Hamilton Ave., Torrance, CA 90509; 213-329-8000

List Price: \$1,295 (3 users); \$7,995 (20 users); runtime module, \$995 (unlimited users per server); upgrade from any standard dBASE version, \$595; upgrade from dBASE IV Developer's Edition, \$195; trade-in from any competitors' SQL Server front-end package, \$595.

Requires: 640K RAM and 1MB extended RAM, 2MB hard disk space (6.5MB for complete installation); DOS 3.1 or later; Novell NetWare, 3Com 3+ Open, or Microsoft LAN Manager required for SQL access.

In Short: A powerful SQL Server front end that dBASE-language programmers will find useful for extending their applications to the client/server model. Its either/or design can be confusing.

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Connections to SQL Server can be made through dBASE IV's Control Panel, but many dBASE commands change behavior when you are in the SQL module.



Our New Departmental PostScript Printer Is So Efficient, You Might As Well Say It Prints Money.

1991
Increased office efficiency
results in increased profitability



Efficiency – The QMS Watchword Of The '90s

Maintaining one high-duty printer rather than 30 to 40 desktop printers is a cost advantage. That's good. But the real advantage comes when the speed, intelligence and flexibility of the new QMS-PS[®] 2000 changes an office cost advantage into a departmental profit center!

Easy Connectivity In All Popular Business Environments

The QMS-PS 2000 is perfect for mixed computing environments. It connects easily to EtherNet[™] or Token Ring[™] networks to accept TCP/IP, DECnet[™], LAN Manager, NetWare[™] and EtherTalk[™] protocols.[†] Whether your network includes IBM[®] PC's and compatibles, Macintosh[®], DEC[®] or UNIX[®] systems, the QMS-PS 2000 is your most efficient solution. It features AppleTalk[®], RS-232C serial, Centronics[®]/Dataproducts[®] parallel and network interfaces that accept data simultaneously. That means the 2000 can easily serve large, multi-system networks. Its advanced spooling capability virtually eliminates workstation waiting time by storing each document as it's received and printing each in turn. And the 2000 does all this automatically to save time!

True Adobe PostScript Flexibility Plus Automatic Emulation Switching

Now departmental documents can have personality thanks to the 2000 and Adobe[®] PostScript[®]. Forty-five resident fonts can be scaled and rotated for effective charts and graphs. And because PostScript is the industry standard, you'll have thousands of useful applications at your fingertips. Switching to non-PostScript applications is literally automatic. QMS's exclusive ESP[®] technology (Emulation Sensing Processor) interprets incoming data and automatically chooses the appropriate printer language. PostScript, HP[®] LaserJet[®] IIP, HP-GL[®], LN03[®] Plus and other emulations are recognized automatically!



Worldwide Service And Support

QMS[®] is recognized as the leader in advanced PostScript printing technology. Free technical support and our network of service experts are standing by.

Call today and find out how the time-efficient, cost-efficient QMS-PS 2000 can be a departmental profit center for your company. Or FAX QMS Product Information at (205) 633-4866.

Features That Add Up To Lower Per-User Cost

- MIPS R3000 RISC-based internal controller for super-fast page processing
- 8 MB RAM standard, expandable to 16 MB
- 1.44 MB, 3 1/2" floppy drive to load fonts or emulations into RAM or onto hard disk
- QMS proprietary ASAP[™] IV technology speeds PostScript processing time
- 20 pages per minute
- 70,000 plus page-per-month duty cycle
- 1500 sheet input and output capacity
- Letter-/A4-, legal, 11"x17"/A3- and executive-size printing capabilities
- Duplexing feature prints on both sides in one pass
- Easy-to-read, multilingual LCD front panel to easily configure printer
- Document handling features include tumble printing, collation, offset stacking and automatic jam recovery.



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[†]Contact QMS for availability of network options

[®]Patent pending

First Looks

Tektronix Mixes Ink Jet Innovations And PostScript 2 to Create One of The Best Color Printers Yet



Tektronix is out to impress the world with its new Phaser III PXi, a plain-paper color PostScript Level 2 printer, aggressively priced at \$9,995.

The PXi is the first color printer to show off Tektronix's new phase-change ink-jet technology and one of the first to use the new color extensions in PostScript Level 2. Tektronix's phase-change technology changes ink from a solid to a liquid. The PXi uses specially designed solid ink cartridges that are melted and then jetted onto plain paper. By controlling the temperature, the phase-change technique assures that the melted ink solidifies just at the point it comes in contact with the paper. These dots are then "smashed" onto the paper through cold-pressure fusing.

In addition to this leapfrog in technology, the printer is equally impressive because it supports four devices simulta-



PostScript Level II, a RISC processor, and Tektronix's phase-change ink-jet technology are at the heart of the Phaser III PXi (originally called the PhaserJet PXi).

neously. The printer has four ports: one 25-pin serial, one Centronics parallel, one AppleTalk din 8 connector, and a SCSI port for an optional external hard disk.

It has built-in intelligence to detect which signal came in first and which page description language is being sent. You can actually have three computers hooked up to the PXi at one

time, which makes any additional printer-sharing devices unnecessary.

The PXi has an ample 1MB buffer for storing incoming data; most other PostScript printers use 100K buffers. There are 39 resident fonts: the standard PostScript 35 plus 4 that include Helvetica Narrow and Condensed.

The PXi blazed through the

ADOBE POSTSCRIPT LEVEL II: Speedier, Smarter, and More Colorful

Today, if you changed your printer from a PostScript Level 1 to a comparable Level 2 device with no changes to your software applications, you would see a noticeable increase in performance.

There are several reasons, but the single most important is that Level 2 allocates memory dynamically. This means an end to PostScript limit-check errors that result from a limited stack memory in the printer.

Another important addition to Level 2 is the support

of image compression schemes. While the PXi does not currently support any of the compatible compression schemes, such as JPEG's (Joint Photographic Experts Group), you should expect to see a raft of printers and image setters with built-in compression in the next six months to a year.

Finally, PostScript Level 2 means that Adobe Systems is doing their house cleaning. All of the language extensions that have been added piecemeal over the years are fully integrated into Lev-

el II. For instance, the CMYK color model was a color extension to earlier PostScript ROM releases, but few printers ever came to market with this support. The seamless integration of CMYK into PostScript Level II means more printers will use this capability.

If you're looking for a PostScript printer today, look for Level 2 support. They're only just beginning to come on the market, but some manufacturers will begin offering Level 2 with no price increase.—GK

FACT FILE

Phaser III PXi

Tektronix Inc., Box 1000, Willsonville, OR 97070; 800-835-6100

List Price: \$9,995; universal tray, \$150; 8 sticks of each color, \$69; additional 4MB RAM, \$995; additional 8MB RAM, \$1,990; 8 sticks of black ink, \$119.

In Short: With its top-notch technology, this B-sized color ink jet boasts Level 2 true Adobe PostScript and HPGL compatibility. Its plain-paper capability and ability to support multiple computers makes the cost per print very attractive.

CIRCLE 707 ON READER SERVICE CARD

PC Magazine Labs printer benchmark tests. We pitted the PXi against three comparable printers: a Tektronix Phaser CP, a Varityper 600W, and an Apple LaserWriter NTX.

With normal color production work, we saw a performance gain over the LaserWriter NTX of 10 to 30 times. A test job that took only 4 minutes on the PXi took 10 minutes on a Varityper 600W and 20 minutes on a Tektronix Phaser CP.

The speed can be attributed partly to the PXi's on-board RISC processor (the AMD 29000), partly to the whopping 10MB of RAM that's standard (expandable to 18MB), and partly to the speed of PostScript Level 2 (see sidebar).

Tektronix claims the printer will print on any paper up to 11 by 17 inches—from thin drafting vellum to card stock. Our own tests proved the card stock was tough going, and had a tendency to jam, although clearing a jam was simple. Tektronix recommends that you use no greater than a 120-pound book or 0.010-inch thickness paper in the printer's standard feed tray. For heavier paper stock the printer has a top-load single sheet feed.

If you need a PostScript color output device that prints sizes up to 11 by 17 inches, this is the one. Technology and price performance make it a clear winner. Just get a sturdy table before you make your buy: The PXi weighs in at 90 pounds. ■



ur Latest PostScript Printer Technology Impressed The Experts...



MacUser,
Editor's Choice Award
(Eddy), Jan. 9, 1991



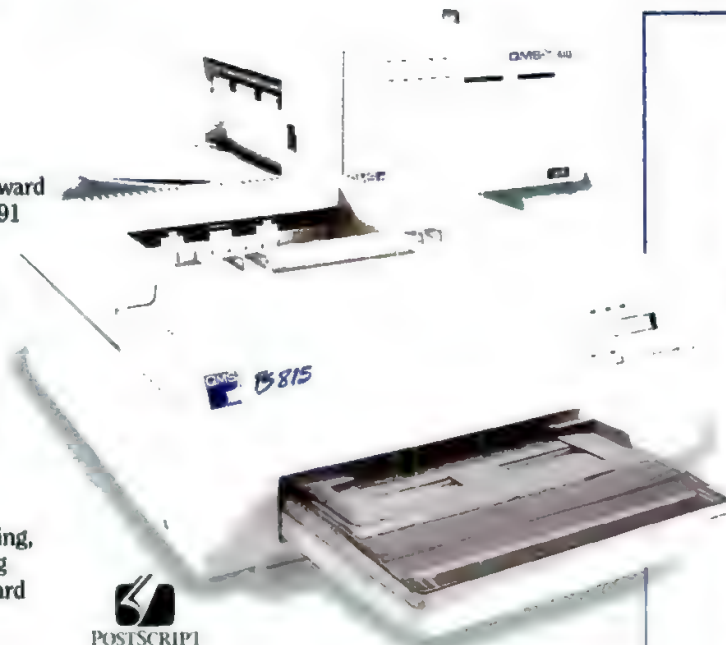
PC/Computing,
Most Valuable
Product,
Nov. 1990



BYTE,
Editor's Product
Merit Award,
Jan. 1991



1990 Personal Publishing,
1990 Outstanding
Achievement Award



POSTSCRIPT

...So We Decided To Give Them More Of A Good Thing.

Before we developed the QMS-PS® 410 four page-per-minute laser printer, we performed one very important task. We listened to what you wanted. Then we engineered a printer light years ahead of the rest with features that aren't available on other printers at any price.

And now, QMS brings you more of a good thing. The QMS-PS 815 and 825. Two eight page-per-minute laser printers with all the leading edge features of the 410 *plus* enhanced processing speed, an increased duty cycle and an easy-to-read, multilingual front panel that lets you quickly configure the printer to suit your specific needs.

Award-Winning Simplicity

How did these printers capture the imagination of an entire industry? The answer is, quite literally, simple! These leading edge printers are so simple to operate they seem to "think for you." Each printer features ESP® (Emulation Sensing Processor) which allows them to interpret incoming data and automatically choose the appropriate printer language without changing switch settings or sending complicated software commands. And to make things still simpler, the 410, 815

and 825 can receive data simultaneously to LocalTalk®, RS-232C serial and Centronics® parallel interfaces, which makes them the best on the market for mixed computer environments. All this and more is the result of QMS's exclusive ASAP™ III technology (Third Generation Advanced System Architecture for PostScript). And it's this proprietary QMS® technology that wins awards *and* customers.

True Adobe PostScript Plus HP Emulations

Whether you choose the 410, 815 or 825, you'll enjoy the desktop design flexibility of the latest version of Adobe® PostScript®. This most recent version includes the output enhancement of Adobe Type Manager™ (ATM). All printers come standard with 45 resident typefaces scalable from 4 points upward and fully rotatable. These PostScript printers guarantee compatibility with thousands of useful PostScript applications currently on the market.

For even greater flexibility, these printers feature standard HP® LaserJet® Series IIP emulation to support non-PostScript printing applications. And a variety of options makes the printers easily expandable. HP-GL®

QMS-PS 410, 815 & 825 PostScript Laser Printers

- ESP - Emulation Sensing Processor (printer interprets incoming printer language and switches automatically)
- SIO-Simultaneous Interface Operation (allows the printer to receive data from three interfaces simultaneously)
- LocalTalk, RS-232C serial and Centronics parallel interfaces (connects to IBM® PC's, Apple® Macintosh® computers and most mini computers and mainframes)
- 45 resident Adobe PostScript typefaces (all can be scaled from 4 points upward, rotatable, all with multilingual character sets)
- Front Panel Display on QMS-PS 815 & 825 (16-digit multilingual LCD array conveys printer status, allows user to quickly configure printer)
- Resident HP LaserJet Series IIP & PostScript emulations (prints PostScript & HP applications, HP-GL emulation cards available)
- QMS ASAP III Technology and 68020 Microprocessor (exclusive technology means fast first-page-out performance)
- PS Executive Series™ Utilities Software (to easily set printer parameters)

emulation cards, HP compatible font cards, memory upgrades and extended paper handling capabilities are all currently available.

Expert Service And Support

As a recognized leader in PostScript printer technology, QMS maintains a commitment to customer satisfaction by providing free, responsive technical support. And to keep your QMS printer operating at its peak, QMS National Service offers a variety of service options. Call us today and see how QMS quite simply makes the best PostScript laser printers in the world. Or FAX QMS Product Information at (205) 633-4866.

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*patent pending

Upfront Makes Short Work of 3-D Modeling, But It May Bring Your 386 to Its Knees

HANDS ON
by Jeff Prosser

Think 3-D modeling has to be hard? It isn't if you're using the new product that makes sketching and rendering in three dimensions as simple as playing with a child's building blocks.

Upfront, from Toronto-based Alias Research, made a name for itself on the Macintosh as a powerful but easy-to-use 3-D solid modeler, but it's technically not a solid modeler. It's actually a polygonal modeler; objects in the scene are composed of one or more flat polygons. Its offspring, the \$995 *Upfront for Windows*, brings the same polygonal modeling to the PC.

Designed primarily as an architect's tool, but versatile enough to fit a wide range of applications, *Upfront* makes short work of modeling buildings, homes, city streets, furniture, and other structures that can be created from blocks, walls, cylinders, and spheres.

Once the model is built, you can move the eyepoint around to get views—complete with perspective—from anywhere. Imported graphics files in a va-

riety of popular graphics formats can be used as backdrops. You can even have *Upfront* adopt the perspective viewing angles of the scenes you import—great for matching objects you create to the scenery around them.

Upfront offers a variety of options for creating objects and for adding a touch of realism to the scene. You can specify the altitude and azimuth of the sun, for example (by time, date, and latitude, if desired), and have your objects cast shadows.

You can import a .DXF drawing from a CAD program (for example, a 2-D floor plan) and use it as a template for drawing. You can add freehand brush strokes with thicknesses and shades of gray to the scene in your choice. You may group objects in layers so that portions of the screen may be viewed selectively. And with the Cut Solid command, which cuts objects where they overlap, you can accurately portray the edges defined by intersecting surfaces and perform CSG-like (constructive solid geometry) Boolean operations.

Anyone who needs to model structures in 3-D before they're

built—architects, engineers, and urban planners, to name a few—will find *Upfront* to be a valuable tool. Possible uses go well beyond the obvious, as in the case of a movie producer who uses his copy of the software to model outdoor sets and analyze shadows cast by the sun to determine what time of day to shoot.

Speed, or the lack of it, is *Upfront*'s greatest liability. Even on a 25-MHz 386 with a math coprocessor, a model that contains a couple of thousand polygons (that may seem like a lot, but it isn't in 3-D) can take up to several minutes to redraw when *Upfront*'s Resort feature, which eliminates small visual errors from the display, is enabled. Most of that time is spent in computation, so a *Windows* graphics coprocessor board won't help.

Adding shadows takes even longer. For optimum performance, you'll want the fastest processor you can get—with a coprocessor—and lots of RAM.

At present, *Upfront* does not include an interface to Pixar's *RenderMan*, which allows packages such as *AutoCAD* and *FastCAD* to generate lifelike



Upfront for Windows, 1.0
Alias Research, 110 Richmond St. East, Toronto, Ontario, Canada M5C 1P1; 416-362-9181.

List Price: \$995.

Requires: 386-based PC or better, 2MB RAM, *Windows* 3.0 or later, DOS 3.1 or later, and a mouse. (4MB to 5MB RAM, math coprocessor, and VGA or better graphics subsystem recommended.)

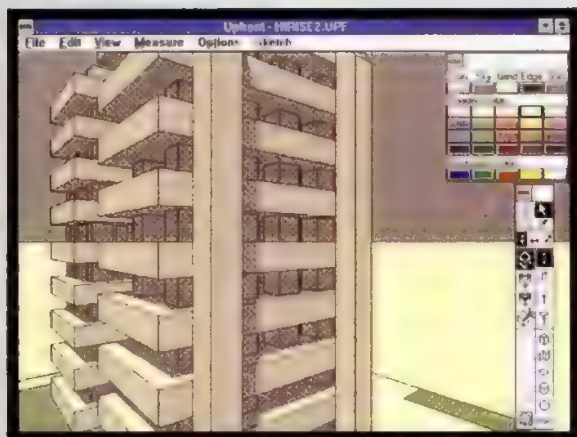
In Short: An interactive *Windows*-based drawing tool for sketching scenes in three dimensions.

CIRCLE 430 ON READER SERVICE CARD

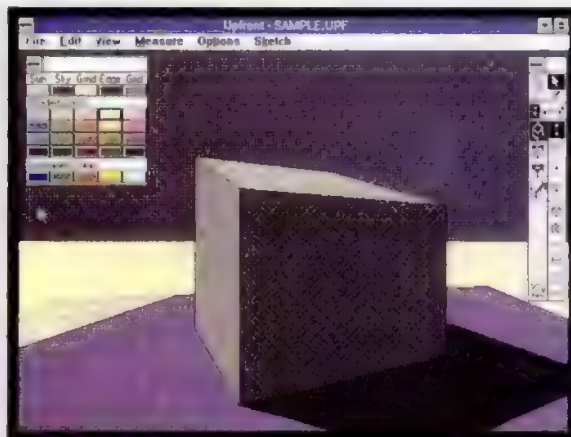
photorealistic images. If photorealistic imaging is important to you, however, you can export models from *Upfront* to *RenderMan*-supported CAD systems.

Upfront comes with several sample files and a small library of objects that you can incorporate into your own models. Its user interface is so well designed that it's a downright pleasure to use.

Once you become proficient with the package (the manual, which is well laid out and loaded with illustrations, will help get you up to speed fast), you can create even complex 3-D models in a fraction of the time that it would take with a full-blown CAD system. In the right situations, that alone should justify the purchase price. ■



Models like this one, which depicts a high-rise office building, can be fashioned in minutes with *Upfront*. Note the use of perspective to make the image lifelike.



The image above features shadows being cast by the sun. *Upfront*'s toolbox and palette windows are visible in the corners of the screen.



After 20 Million Pages Of PostScript Color Output, The Last One Looks As Great As The First.



QMS ColorScript Printers... Brilliant and Resilient

Since 1987, QMS ColorScript™ 100 printers have produced over 20 Million hard copies and transparencies around the world! And because this color technology is engineered to use new ink with each print, the last page literally looks as bright and true as the first. This reliable QMS™ technology has been united with the industry standards of Adobe® PostScript® and PANTONE® Color to put exciting, persuasive color at your fingertips page after page.

Presenting The ColorScript Model 10 Printer

If it's dynamic presentations you're after, you need the Model 10. From business presentations to training programs, the Model 10 delivers vibrant, visually exciting colors that help you communicate ideas clearly. QMS screen angling technology and special presentation inks make these unusually captivating colors possible. And it's a proven fact that color presentations increase audience information retention and raise a

MacWorld World Class Award
September 1990
PC Magazine Editors Choice
November 14, 1989

recipient's tendency to act upon the information. So, in today's competitive business environment, the key question becomes, "Can we afford *not* to have the power of color?"

The ColorScript Model 30i Printer, Strictly For The Image Conscious

Extremely low cost Pantone-approved proofs in about 60 seconds. If you're a graphic designer, commercial artist or publisher it's easy to see how the Model 30i is revolutionizing your business. The QMS ColorScript 100 Model 30i is changing the relationship between speed, quality and cost by allowing you to do your job faster, cheaper *and* better!

The Model 30i is the first true "what-you-see-is-what-you-get" color printer. The colors you see on a Pantone-approved monitor are the same colors you'll see on a Model 30i proof *and* the same colors you'll see on the finished, printed piece. And the standard 11" x 17"/A3 paper handling capacity allows you to design actual size 8 1/2" x 11" full bleed proofs with crop marks.

True Adobe PostScript Guarantees Compatibility

Since Adobe introduced the PostScript page description language in 1984, it's become the industry standard for electronic printing and publishing. And

Features That Will Color Your Perception Of Business And Design Forever

- Compatible with Macintosh computers, IBM PC's and clones and other popular systems
- 35 resident Adobe PostScript typefaces all scalable and rotatable
- Model 30i has standard 8 MB RAM/1 MB ROM
- Model 10 has standard 5 MB RAM expandable to 8 MB RAM
- Model 10 prints letter- and legal-size paper and transparencies
- Model 30i prints letter-size and 11" x 17" paper and transparencies
- AppleTalk™/RS-422, RS-232 serial and Centronics® parallel interfaces provide compatibility with most micro, mini, mainframe and workstation hosts
- External SCSI interface supports up to seven additional hard drives of unlimited size
- 68020 MPU-based controller plus exclusive QMS ASAP™ technology means fast first-page-out performance
- Prints high-quality Adobe PostScript text and graphics at 300 x 300 dots per inch
- HP-GL® emulation software included

with the QMS ColorScript 100 Model 10 and Model 30i, you get guaranteed compatibility and consistency. PostScript imitations, on the other hand, may not be 100 percent compatible with Adobe's PostScript.

Two Top Performers Right Out Of The Box

Whether you choose the Model 10 or the Model 30i you can be up and running within minutes. Both printers are designed for maximum compatibility with Macintosh® computers, IBM® PC's and compatibles as well as many other systems. And, for additional support, QMS's technical and service professionals are standing by to assist you with answers that will get you up to speed fast. Call us today and we'll help you decide which printer best suits your needs. Or FAX QMS Product Information at (205) 633-4866.

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Two Ways to Run a PC as Host: Digital Replaces DOS and Citrix Builds on OS/2

There are sweeping changes going on in the operating system business: IBM and Microsoft have taken separate paths, and Novell has acquired Digital Research.



DRMultiuser DOS

Concurrent DOS by Digital Research was the first multitasking, multiuser operating system specifically designed for IBM personal computers.

Unfortunately, it had a reputation for being quirky, and not entirely MS-DOS compatible. That reputation has changed over time: Digital Research's DRMultiuser DOS 5.0 works, and works well.

DRMultiuser DOS shares technology with DR DOS 5.0 but requires a 386SX-based machine or better. It can support up to 16 concurrent users, but this can be increased to 64 with third-party multiport drivers. Each user can have up to eight active sessions, limited only by available RAM.

DRMultiuser DOS can also be used as a multitasker for standalone systems and will support up to four graphics programs (including Windows 3.0) on the "console" or host system—again limited to available memory. Disk swapping is not supported.

DRMultiuser DOS can support only CGA or nongraphics applications on terminals because the overhead of graphics files makes the serial transfers too slow. The system can be set up with user security features that limit access to files, directories, and other resources, or left open for use as a single-user multitasker.

The task-switching menu pops up when the Ctrl-Esc keys are pressed; direct switching can be executed by pressing Ctrl and the task number. EMS

But the following two products offer solutions for today that expand current operating systems. These products allow you to build a multiuser system on a limited budget.

memory is allocated as needed to applications that use it; maximum amounts can be configured by the administrator.

MS-DOS compatibility was excellent when we tried the system with a number of applications. If you do encounter a compatibility problem, you can use a dual-boot option that allows you to choose between multiuser DOS or regular DOS.

Unfortunately, Digital Research chose to copy-protect the system using a printer port plug that must be present at boot time and is checked at random times during use. (There are OEM versions of DRMultiuser DOS that aren't copy protected.)

Novell's recent purchase of Digital Research may mean even more improvements to DRMultiuser DOS in coming years (see Pipeline, page 29). In the meantime, you'll find it's a stable product for multiusers and for multitasking DOS applications right now. ■

List Price: DRMultiuser DOS Version 5.0, \$695. **Requires:** 386SX processor or better, 2MB RAM plus 1MB per additional three sessions, hard disk, parallel port. Copy protected. Digital Research Inc., P.O. Box DR1, Monterey, CA 93942; 800-274-4374, 408-649-3896.

CIRCLE 700 ON READER SERVICE CARD

Citrix Multiuser

OS/2's future is still very much in question, as we all wait to see if IBM can deliver the capabilities promised for Version 2.0 (see Pipeline, June 25, 1991).

In the interim, Citrix Systems has "kept the OS/2 faith" and released Citrix Multiuser, a multiuser version of OS/2 1.21.

Citrix Multiuser lets connected PCs run one or more character-mode OS/2 programs on the host system.

It also provides access to more than four COM ports by supporting a number of multiport boards.

A dial-in connection is possible with an ANSI-compatible communications program, or with Citrix's \$99 *Multiuser Link*. You can transfer files to and from the host using the Zmodem protocol that's sup-

plied as part of the system.

The installation program is similar to OS/2's but offers some additional options. Unlike single-user OS/2, Citrix's user security system requires that the hard disk be formatted with the HPFS (High Performance File System). Once installed, the system administrator uses the CONFIG utility to set up profiles and security access.

Security is paramount in a multiuser system, and Citrix has done a good job. Four levels of access—ranging from guest to administrator—can be set on the user or group level. Individual files and directories can also be protected with explicit rights, such as read-only, read-write, or execute-only. The security system is virtually identical to LAN Manager 2.0's.

The first thing the user sees after he logs onto the system is the OS/2 Program Selector and Task Manager, identical to those in OS/2 1.0. From here, the user can run either preconfigured applications, or access full-screen OS/2 command line sessions.

Each user has a private directory on the system, accessible only by that user and the system administrator; the configuration files for the Program Selector are stored here, letting the administrator establish different menus for different users or groups.

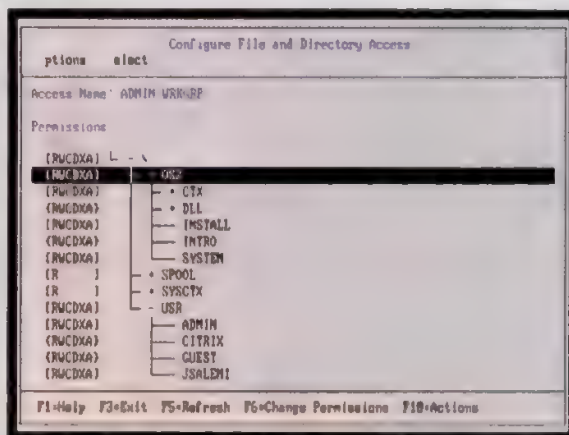
The initial package supports five users, and Citrix sells "doubler packs" to add more users.

Citrix Multiuser provides a capable alternative for those who want a non-Unix multiuser system that lets them continue using familiar DOS-style commands. Its biggest drawback is its lack of support for DOS or OS/2 Presentation Manager programs. ■

List Price: Citrix Multiuser, Version 1.0, \$995 (five users); doubler pack (doubles authorized users), \$495.

Requires: 386SX or better processor, 3MB RAM, 10MB hard disk, one high-density floppy disk. Citrix Systems Inc., 210 University Dr., #700, Coral Springs, FL 33071-9908; 305-755-0998.

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Citrix Multiuser is comprised of Microsoft OS/2 and extensions that support multiple users; a password security system is used.

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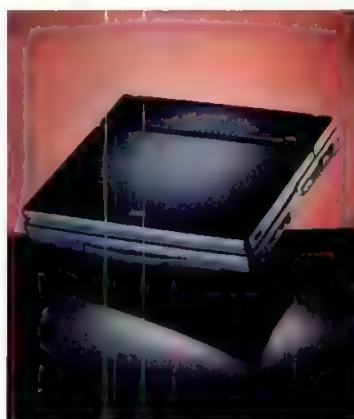
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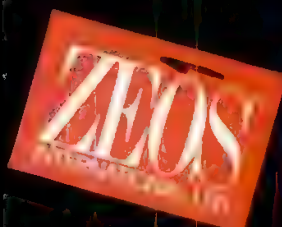
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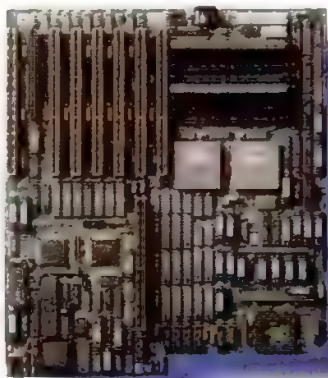
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First Looks

Hands-on Reviews of the Latest Products

Windows Will Never Be the Same

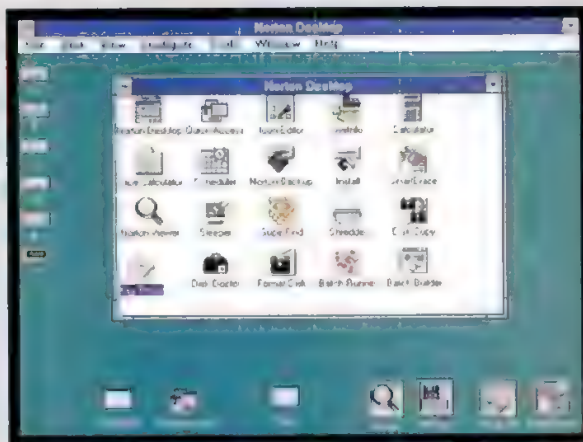
\$149 Norton Desktop for Windows Changes the Face Of File Manager and Program Manager with 20 Utilities



The *Windows* desktop utility landscape will never be the same. Symantec Corp.'s *The Norton Desktop for Windows* (NDW) is an amazing collection of just about all the general-purpose utilities you could ever want for *Microsoft Windows*, with the only exceptions a calendar and a phone dialer. With a price of \$149, Symantec is very serious about making this program the leading *Windows* utility package.

Included in the package are replacements for *Windows* File Manager and Program Manager, as well as *The Norton Backup for Windows*, numerous file viewers, a full-fledged batch language, and several programs from *The Norton DOS Utilities* that handle disaster recovery.

NDW's slick installation uses a new program from the Sterling Group (708-307-9197) that you'll probably see in other



The Norton Desktop for Windows combines the features in the *Windows* Program Manager and File Manager. When you click on a drive icon, it will display a directory and list the files. In addition, 20 utilities are provided for system backup, undelete, and text searches.

Windows programs.

When you run the main *Norton Desktop for Windows* program, your old *Windows* desktop takes on a brand new face.

There's more color, more icons, and a more graphical (okay, more Mac-like) way of working with *Windows* files.

The centerpiece of this col-



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Edition: SQL query spells relief for dBASE users.....42

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dBFast: Small company makes first plunge into *Windows* xBASE compilers.....50

lection is called *Norton Desktop*. It cooperates with a second utility called *Quick Access* to provide a rich integrated environment for manipulating files and running applications.

Norton Desktop will put to rest any complaints you have about *ProgMan* and *FileMan*, and still goes far beyond what you'd expect. *Quick Access* groups look like *ProgMan* groups, but *Quick Access* performs as if it has had a shot of steroids.

CONTINUES ON PAGE 36

50-MHz 486 Debuts in Dell PowerLine File Server

HANDS ON
by Patrick Honan

Dell Computer Corp.'s *PowerLine 450SE* is the first computer to reach PC Magazine Labs with Intel's new 50-MHz 486 processor. The *PowerLine 450SE* may be ahead of the pack for pure speed, but it stays in line with today's prevailing trends for high-end machines.

The *PowerLine* family of file servers uses an upgradable

CPU design. You can select the 20-MHz 486SX-based 420SE or 33-MHz 486-based 433SE and then upgrade to the faster 50-MHz 486-based processor later. Dell uses a passive motherboard design; this means that the CPU, Dell's own cache controller, and cache memory are on a 32-bit daughtercard that plugs into a dedicated slot on the motherboard.

Dell complements the fast

CONTINUES ON PAGE 37



PHOTOGRAPHY: THOMAS CONNER

First Looks

Norton

CONTINUED FROM PAGE 35

You can also do all sorts of things with groups that you couldn't do before. A group can remain on the desktop whether or not the main launch window is open. You can place subgroups within groups. Each launch item can have a unique startup directory; they are not confined to starting from the program's directory.

Included in the program is a special startup group. All you need to do to launch a program on startup is to drag an icon to the startup icon; no need to modify your WIN.INI file to add a LOAD or RUN command.

If you don't care much for the "ProgMan as launcher" metaphor, Norton gives you alternatives. You can use a menu bar that Norton Desktop places at the top of the screen, customizing it to accommodate your own programs, even setting up your own submenus.

Or you can use the control menu that Norton Desktop alters to include three additional items. One of these gives a submenu of running tasks. Another invokes a menu of applications that you set up by calling the last of these extra items, a module called the Launch Manager.

Finally, any applications that you set up in Quick Access

or from the Launch Manager can have hotkeys associated with them, giving you another way to launch a program.

As you would expect from a Peter Norton product, file management is deftly handled. By default, the left column of the desktop contains icons for each of your disk drives. Double-clicking on a drive icon opens a pop-up window that displays a directory tree on the left and a file list linked to the chosen directory on the right. Multiple drives or multiple views of a single drive can be opened simultaneously. An additional window can be opened to view a highlighted file.

Copying and moving files is as easy as dragging icons from one file window to another. If you prefer, you can select a copy or move button, and pick the destination from a dialog. There are also on-screen buttons to delete files, or you can call the Superfind module.

Norton Viewer, the file-viewing engine, and Superfind, the file- and text-search utility, are linked to the drive windows; they also can be run standalone.

Included in the package are viewers for the leading word processors, spreadsheets, and databases. You can view the directories of .ZIP, .ARC, and .LHA files, but you cannot view the contents of these files the way you can with Lotus's *Magellan*. Graphics viewers include .BMP, .ICO, .PCX, .GIF, .TIFF, but not CGM or



NORTON THROWS IN EVERYTHING BUT THE KITCHEN SINK

In the DOS world, *The Norton Utilities* serves up a "can't-live-without-'em" slew of tools for fixing disk problems. Symantec Corp. complements this collection with additional products for file backup (*The Norton Backup*) and simple file management (*The Norton Commander*).

In making the transition to *Windows*, Symantec is taking the same Swiss Army knife strategy that its archrival, Central Point Software, took with *PC Tools Deluxe*. *The Norton Desktop for Windows* combines most of the features in *The Norton Utilities*, *The Norton Commander*, and *The Norton Backup*.

Here's what you get in *The Norton Desktop for Windows*:

- Norton Desktop: copies, moves, and deletes files; launches programs.
- Quick Access: launches programs.
- Icon Editor: creates and manages icons.
- SysInfo: provides comprehensive system reporting.
- Calculators: includes a conventional calculator (with on-screen "tape") and a scientific calculator.
- Scheduler: sets alarms and enables unattended program launching.
- Smart Erase: retains files for a user-specified period after deletion.
- Norton Viewer: contains file viewers for text, .EXE, *Microsoft Word*, *WordPerfect*, *Lotus 1-2-3*, *Microsoft Excel*, *dBASE*, .BMP, .GIF, .PCX, .ZIP, .ARC, .LHA, .ICO, and TIFF.
- Sleeper: blanks screen with a choice of 13 graphics displays.
- Superfind: has file finder and text search functions.
- Shredder: provides a file wipe utility.
- DiskCopy: makes an identical copy of a disk.
- Keyfinder: picks font displays and characters.
- Windows Disk Doctor: diagnoses disk problems outside *Windows*.
- Format Disk: formats floppy disks.
- Batch Builder: creates *Norton* batch files.
- Batch Runner: provides a *Windows* batch language.
- DOS Disk Doctor: diagnoses and corrects DOS-level disk problems.
- SpeedDisk: defragments disks.
- Unformat: recovers an entire hard disk.
- Unerase: unerases DOS files.

.WMF. Norton Viewer supports the *Windows* multiple document interface (MDI) so you can view multiple files simultaneously in separate subwindows.

Icons are another example of

how *NDW* takes up where *Windows* left off. You can drag any icon out of a Quick Access window, or any file out of a drive window, and place it on your desktop where it is portrayed as an icon on a raised gray background. Double-clicking on these icons launches their associated programs.

In addition, Shredder (the equivalent of Norton's DOS-based Wipe utility), Smart Erase (the equivalent of the Macintosh trash can), Norton Viewer, a backup utility, and a print tool can each be optionally placed in a framed icon, creating something of an object-oriented environment.

Double-clicking on the print tool, for example, invokes the *Windows* printer dialog box. Dragging a file to the print tool prints the file. If the file is associated with an application, then Norton Desktop launches the program with the filename as a parameter and sends Alt-F-P

NORTON'S NEW BATCH LANGUAGE

Much of the power in *The Norton Desktop for Windows* comes from its powerful batch language.

You can use the language to do things like launch applications, and then move, minimize, maximize, or hide windows. You can change the displayed title of any main window, get input from a simple text box or from a dialog box.

A simple editor, Batch Builder, lets you create the

scripts, and will pop up a list of the language's 100-plus commands and their syntax.

The batch language is bare bones: There are "if-then" and "GOTO" constructs, but no "Else," "Case," or "For" loops. However, with the language's arithmetic abilities, you can roll your own.

There are strings and integers but no arrays, and there is a single-step debug mode. *NDW*'s batch lan-

guage doesn't have the elegance of Softbridge's *Bridge Batch for Windows*. That language has a WYSIWYG dialog box maker, as well as DDE support, arrays, and structured language.

Wilson Windowware's \$70 shareware program *Winbatch* is identical to *NDW*'s batch language, and *Winbatch* includes a macro program that's not available in *The Norton Desktop For Windows*.—BS

keystrokes to the application to start printing. Similarly, you can act on a file by dragging it to the Shredder or Viewer.

Windows is the ideal backup environment since it allows you to perform backups in the background, and *NDW* takes full advantage of the situation. The package includes a full-featured *Windows*-based backup program and a scheduler which, for example, allows you to configure your system to do a daily backup at a preset time. The backup program lets you choose files from a dual window tree and file dialog. You can save backup configurations and file choices for more automated backups.

The backup program performed with speed and grace. It handled the curve balls we threw at it, such as inserting a 360K floppy disk in the middle of a 1.2MB backup.

The desktop also includes the disk disaster protection that you've come to associate with *Norton*. By loading Smart Erase as a TSR, you can store erased files in a separate directory until you explicitly purge them, or until a specified time has passed. A more standard Unerase program is provided, too.

NDW runs Disk Doctor, but only as a diagnostic tool. However, DOS-based Disk Doctor, which does the fixing, is included in this package. Also borrowed from *The Norton Utilities* are an Unformat program, a DOS-level Unerase, and a defrager.

Scattered throughout the modules are thoughtful little extras. For example, there's a sales tax button built into the calculator. There are improvements to the way in which *Windows* searches file list boxes, too. Instead of being relegated

to typing only the first letter of a file, you get a pop-up box that allows you to type as much information as you need.

And just to make sure this is a total solution for *Windows*, Symantec has added the small touches, like an icon editor and a screen-saver with password protection.

I can't imagine any *Windows* user who won't want to own this magnificent, cost-effective collection.

Whether you are a power user who wants more out of *Windows*, or a novice who originally shied away from some of *Windows*' idiosyncrasies, you'll find something in *NDW* to make your life easier. There's a good chance that you'll find *The Norton Desktop for Windows* provides the most profound changes in the *Windows* environment since the introduction of *Windows* 3.0 itself. ■



FACT FILE

The Norton Desktop For Windows, Version 1.0

Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014; 408-253-9600.

List Price: \$149

Requires: 286-based PC or better, 1MB of RAM (3MB recommended), 4MB hard disk space, DOS 3.1 or later, *Windows* 3.0 or later.

In Short: Norton comes to *Windows* with a profound effect. A collection of utilities that will change the way *Windows* users think about *Windows*. Some of the functions provided are program launching, file management, backup, screen blanking, system information, and emergency disk recovery. There are also two calculators, a batch language, and a key finder.

CIRCLE 705 ON READER SERVICE CARD

Dell 50-MHz 486

CONTINUED FROM PAGE 35

processing speed with an EISA bus, generous expansion, and intelligent internal design, making the PowerLine 450SE a solid choice as a network file server for those not seeking a multi-processor-based system.

All the models in Dell's PowerLine SE line come in the same 24- by 7.6- by 22.2-inch (HWD) tower case and use the EISA bus. (Dell offers the PowerLine DE series, a desktop version that has less expansion potential. The PowerLine DE offers five drive bays, three of which accept removable media. It also features six EISA expansion slots.)

Pricing for the 450SE is reasonable when you consider that the 50-MHz chip is brand new. The tested machine costs \$12,327, including 8MB of RAM, a Super VGA display subsystem, both 1.2MB and 1.44MB floppy disk drives, a 330MB hard disk with a 32-bit EISA controller, and Microsoft's new DOS 5.0.

For those looking to grow into a 50-MHz 486 file server, a PowerLine 420SE (20-MHz 486SX) with 4MB of RAM, Super VGA, one floppy disk, and an 80MB IDE hard disk costs

\$5,399. Upgrading the CPU daughterboard costs \$2,599 (from a 20-MHz 486SX to a 33-MHz 486), \$4,999 (from a 486SX to a 50-MHz 486 board), and \$3,299 (from a 33-MHz to a 50-MHz 486). The upgrade includes an allowance for trading in the daughterboard.

Like Intel's other 486 processors, the 50-MHz chip has an internal 8K RAM cache. To that Dell adds a 128K cache controller of its own design, eschewing Intel's CPU daughtercard, the 50-MHz Intel 486DX CPU-Cache. (See "The 50-MHz 486 is Just One of Several New Processors Intel Is Planning" for

more information on Intel's 486DX CPU-Cache.)

Intel's CPU-Cache features a 256K cache controller, but a Dell spokesman told us that the Intel cache design would add hundreds of dollars to the price with a negligible speed improvement in the disk-intensive server applications the 450SE is designed to handle. The Intel design is better suited for multi-processor systems, while Dell's own direct map write-through cache has been optimized for the PowerLine 450SE.

The reviewed unit has a 32-bit EISA hard disk controller from UltraStor equipped with

4MB of cached memory. Dell also offers its Dell Drive Array (DDA). Priced at \$1,999, this 32-bit EISA controller supports up to ten IDE hard disks and has an Intel 960 RISC chip that handles I/O processing. Network administrators can configure DDA in several ways for the backup and restoration of data, should one or more of the hard disks fail.

The faster performance of the 50-MHz 486 chip was clear in PC Magazine Labs' processor tests. The 450SE runs our 486 Instruction Mix benchmark test in roughly two-thirds the time of the Compaq Systempro

THE 50-MHZ 486 IS JUST ONE OF SEVERAL NEW PROCESSORS INTEL IS PLANNING

by Robin Raskin

Besides being 50 percent faster than the 33-MHz version, Intel's new 50-MHz 486DX microprocessor differs from its 33-MHz predecessor in two ways: in its manufacturing process and its packaging.

Instead of the 33-MHz's 1 micron, two-layer metal

CHMOS-IV process, the new 50-MHz 80486 chip uses a 0.8 micron, three-layer CHMOS-V metal process. The extra layer lets Intel cut the vertical size of the chip to about half the size of the 33 MHz.

Intel has demonstrated a 100-MHz 486DX chip that uses the same fabrication

process, and has discussed plans for the next-generation 586 chip (code-named P5), a 3-million transistor chip with superscalar RISC features, which will run at speeds greater than 100 mips (million instructions per second). The first of these P5 chips is expected to reach

CONTINUES ON PAGE 38

equipped with a single 33-MHz 486 processor. The PowerLine 450SE also scores well on the small- and large-record DOS File Access benchmark tests, and on the BIOS Disk Seek benchmark tests, but these tests reflect performance on a stand-alone system rather than a file server and do not indicate the full difference a 32-bit EISA controller will make in certain networking situations.

Dell's PowerLine SE family offers plenty of room for expansion. The 450SE has eleven half-height drive bays, five of which accept removable media. There are eight EISA slots; seven are open, since the video, serial, and parallel ports reside on a proprietary daughtercard.

The standard 300-watt power supply is enough for most configurations, but you'll need an additional 55-watt power supply (\$99) for systems with more than four 650MB hard disks or eight smaller-capacity hard disks. You can add memory in the eight SIMM sockets located on the system board; maximum system memory is 128MB (achieved by using eight 16MB memory modules).

The PowerLine 450SE also features a proprietary firmware subsystem that uses Intel Flash memory to store the system BIOS. In the future, users will be able to upgrade system BIOS by installing a new file from a floppy disk.

Aside from its solid technological features, the PowerLine 450SE has some of the best ergonomic elements in personal computer design since IBM came out with the PS/2. The PowerLine's shipping cart opens to become an unloading ramp. The unit is on wheels and has a convenient handle on the front. Ports are along the top of the computer rather than the rear, making it easier to connect cables. Finally, there are no screws to unfasten to get inside the machine. The case's right side simply snaps off with a few strong tugs at the corners.

The PowerLine 450SE comes with a one-year parts-and-labor warranty, on-site service from Xerox, and toll-free technical support Monday through Saturday.

Intel Planning News Processors (CONTINUED)

system designers by mid 1992.

Intel has also announced, and is close to delivering, a family of processors that will operate twice as fast internally as they do externally. Initially these products will be available as 486SX processors (that is, without an internal math coprocessor), although Intel may bring the concept to other processors.

These new processors (sometimes called "dual clock") will double performance by executing two instructions per clock cycle. While earlier Intel processors required several clock cycles to execute a single instruction, the 486 executes an instruction with every clock cycle. When a processor can execute two instructions per cycle, it has effectively doubled performance for that clock speed.

These 40/20-MHz, 50/25-MHz and 66/33-MHz

processors (internal/external) free designers from having to redesign circuit boards to accommodate a speedier generation of chips. And they allow higher performance at relatively lower clock frequencies to reduce the radio emission problems that hamper the design of systems with clock frequencies above 33 MHz.

All of the chips in the 486 microprocessor family have an 8K primary internal cache, but at 50 MHz and beyond, it will become important to reduce the imbalance between processor and memory speeds. To this end, Intel created the 50-MHz Intel 486DX CPU-Cache module to help reduce traffic on the memory bus. Effectively, the cache controller monitors or "snoops on" the bus to see if the data that is being written to memory is in the cache. If so, it purges the existing cache data to keep the contents of the cache coherent with system memory.

ent with system memory.

Intel's CPU-Cache includes a cache controller and nine 32K dual-ported SRAM buffers and registers (one for parity and 256K for data). The cache module can run synchronously or asynchronously with the rest of the system so that the CPU and local memory can access the cache concurrently.

The Dell PowerLine reviewed here uses its own proprietary cache, in part because it's less expensive, and in part because the Intel CPU-Cache's design is strongest in multiprocessing environments; the Dell PowerLine has a single CPU.

Intel's real goal is to help beat the RISC chip threat by tailoring future processors to meet specific needs. The result should be continued compatibility between desktop PCs and servers, with a greater number of choices at each level.

Dell Computer Corp. has been on a hot streak lately, winning a larger market share as it debuts one solid machine after another. With the PowerLine 450SE's CPU speed, the I/O capabilities of the EISA bus, and the solid expansion options, Dell rolls another seven.



FACT FILE

Dell PowerLine 450SE
Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759-7299; 800-289-3355, 512-338-4400.
List Price: With 8MB RAM, 330MB hard disk with the 32-bit EISA controller, 1.2MB and 1.44MB floppy disk drives, Super VGA display subsystem, DOS 5.0, \$12,327.
In Short: While the Dell PowerLine 450SE features Intel's fastest processor to date, its thoughtful all-around design makes it a worthy file server for any network.

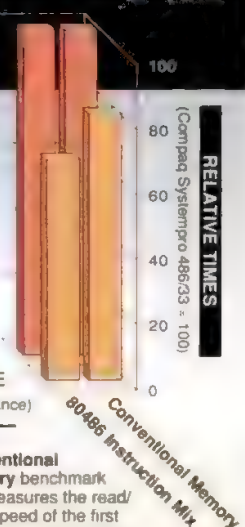
CIRCLE 704 ON READER SERVICE CARD



BENCHMARK TESTS: DELL POWERLINE 450SE

The Dell PowerLine 450SE raises computing to new heights with its Intel 50-MHz 486DX CPU and Dell's own 128K external cache. Dell has forsaken Intel's 486DX CPU cache for its own proprietary design, a direct-map write-through cache with 14-nanosecond SRAM. The result: Dell's 50-MHz file server significantly outperformed a 33-MHz 486 Compaq Systempro on our tests, surpassing the Systempro's performance time by 32 percent.

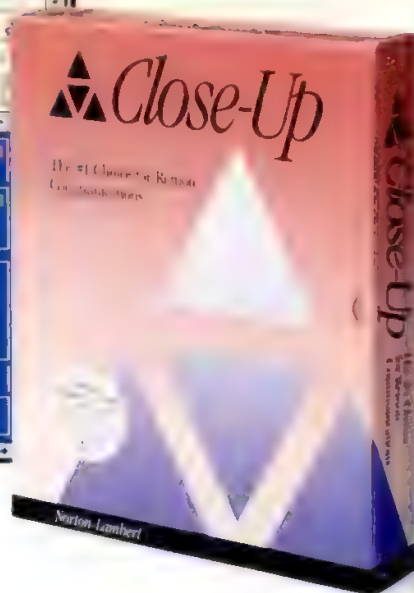
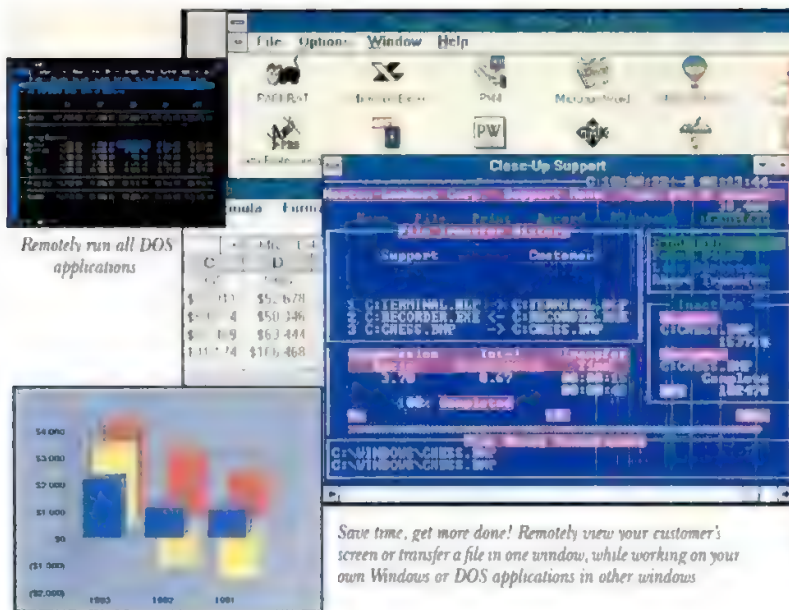
Compaq Systempro 486/33
Dell PowerLine 450SE
(Shorter bars represent better performance)



The Instruction Mix benchmark tests a series of tasks specific to the processor. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.

The Conventional Memory benchmark test measures the read/write speed of the first 640K of memory. Slower times can indicate the presence of memory wait states or memory chips rated at relatively slow access speeds.

Performance Times (Times given in seconds) (Lower scores represent better performance)	80486 Instruction Mix	Conventional Memory
Compaq Systempro 486/33	1.12	0.17
Dell PowerLine 450SE	0.76	0.14



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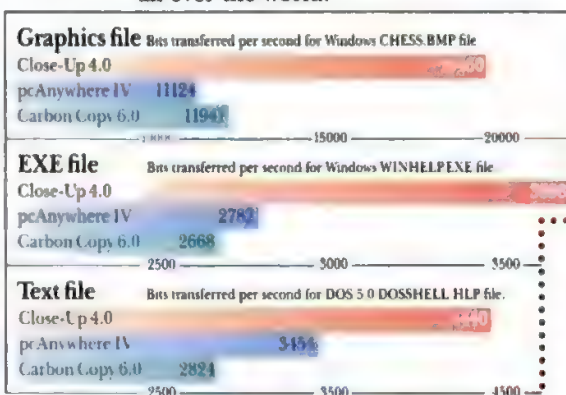
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†Speeds computed in Bits Per Second (BPS) on Everex 486 PCs using Hayes 2400 baud Smartmodems. Speeds are average of 4 transfers; 2 sends and 2 fetches. Files transferred can be found in Windows 3.0: WINHELPEXE size 199,552 bytes, CHESS.BMP size 153,718 bytes. In DOS 5.0: DOSHELL.HLP size 161,763 bytes. Windows is a trademark of Microsoft. © Copyright 1991, Norton-Lambert Corp.

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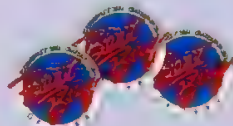
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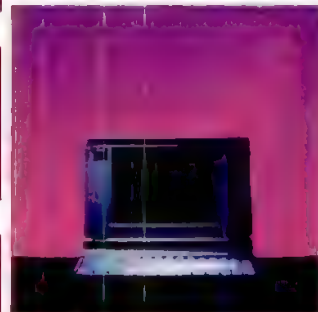
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First Looks

dBASE SQL Server Suffers From a Split Personality

HANDS ON
by Joe Salemi

With the news of Borland's merger with Ashton-Tate, it's expected that many questions will be raised about the future of the dBASE language (for some of the answers, see Pipeline, page 29).

With the release of dBASE IV Server Edition, however, Ashton-Tate is delivering on a commitment it made several years ago to bring the language to SQL Server.

The name *Server Edition* is somewhat misleading, as this dBASE release is designed to let you access data on the Microsoft/Sybase SQL Server from within dBASE; it does not provide any database server functions of its own. The basic package can be installed standalone or on a LAN, allowing three simultaneous users to access either shared dBASE files or SQL Server files.

When we last looked at dBASE IV ("15 Relational Databases, Easy Access, Programming Power," May 28, 1991), we complained about the implementation of its SQL interface. The SQL module in the *Server*

Edition is vastly improved—but now it almost seems like an entirely separate product. When dBASE is in SQL mode, many of the dBASE functions are either disabled or change their behavior.

Here's how the *Server Edition* works: SQL commands are used to retrieve the data, and dBASE commands are used to process and format it for the screen or printing. dBASE's built-in SQL commands can still be used to access dBASE data and index files, though the DBDEFINE command must first be run against them to store the appropriate information in the SQL catalogs.

But once dBASE is in SQL mode, and the database being accessed resides on the SQL server, any dBASE commands that make physical changes to the database itself are disabled. For example, the SQL commands CREATE TABLE and ALTER TABLE are used to define or change the structure of the database tables, replacing the dBASE CREATE/MODIFY STRUCTURE; CREATE INDEX is used instead of INDEX ON to establish indexes.

An additional parameter for

the SQL SELECT command lets the results of a query on the SQL server be saved in a local .DBF file.

When SQL commands are run against local .DBF files, the commands are internally translated to dBASE commands before being processed. However, when the SQL commands are issued against a SQL Server database, dBASE either passes them on directly, or translates them to the appropriate TRANSACT-SQL (SQL Server's native language) commands. Because of this, transactions against a SQL Server database usually execute faster than they do against a local database containing the same data.

You switch between dBASE and SQL modes interactively. SQL program files are distinguished from regular dBASE programs by using a .PRS instead of .PRG file extension. SQL programs and dBASE programs can be intermixed in the same application, by chaining to the different program modules. SQL programs can also use what is called "dynamic SQL." These are commands that are a subset of the dBASE SQL statements, and are constructed and executed when the application is run.

Standard dBASE commands are used to query the application's user for input, and then pass the input to SQL commands through memory variables. This is a powerful feature that allows developers to design ad-hoc queries into the application.

Unlike standard dBASE IV, the *Server Edition* includes the DOS/16M Extender, giving it access to extended memory to store and run application code. In fact, it requires at least 1MB of extended memory to run, though its low RAM (RAM below 640K) requirements are reduced to needing only 60K free.

The external DBSETUP program used to configure dBASE has an additional option that controls the behavior of the DOS/16M, including the amounts of memory it can use, and where its swap file should be located. These settings can have a noticeable impact on performance, so the developer or

LAN administrator should use this utility to fine-tune the *Server Edition* when creating applications.

The installation process is the same as that of the regular dBASE IV 1.1 package. However, one bug has crept in; if the included HyperDisk cache (DBCACHE) is enabled during the installation process, the process will randomly fail at some later point while unpacking the files. When this happens, the entire 14-disk installation must be started from the beginning.

The installation program also copies a README.DOC file to the hard disk that contains important update information, and should be read before using the product for the first time.

The dBASE IV *Server Edition* is a useful front end for SQL Server; programmers familiar with the dBASE programming language will find it easy to extend their applications to the client/server architecture. Compared with *Paradox SQL Link* or *DataEase SQL*, though, it's not as tightly integrated into the system as it could be, and users may find its schizophrenic nature confusing. ■



FACT FILE

dBASE IV Server Edition,

Version 1.1

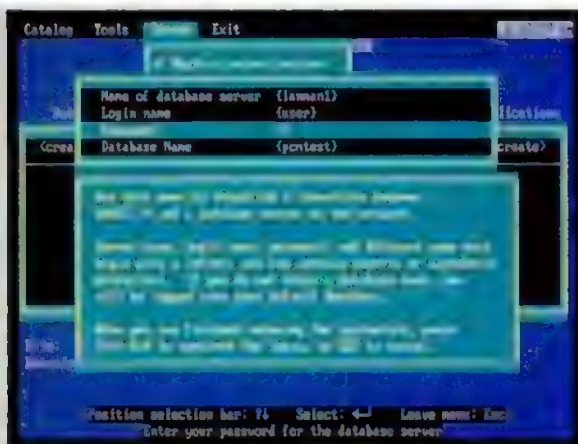
Ashton-Tate, 20101 Hamilton Ave., Torrance, CA 90509; 213-329-8000.

List Price: \$1,295 (3 users); \$7,995 (20 users); runtime module, \$995 (unlimited users per server); upgrade from any standard dBASE version, \$595; upgrade from dBASE IV Developer's Edition, \$195; trade-in from any competitors' SQL Server front-end package, \$595.

Requires: 640K RAM and 1MB extended RAM, 2MB hard disk space (6.5MB for complete installation); DOS 3.1 or later; Novell NetWare, 3Com 3+ Open, or Microsoft LAN Manager required for SQL access.

In Short: A powerful SQL Server front end that dBASE-language programmers will find useful for extending their applications to the client/server model. Its either/or design can be confusing.

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Connections to SQL Server can be made through dBASE IV's Control Panel, but many dBASE commands change behavior when you are in the SQL module.



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- Easy-to-read, multilingual LCD front panel to easily configure printer
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POSTSCRIPT

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*Contact QMS for availability of network options

*Patent pending

First Looks

Tektronix Mixes Ink Jet Innovations And PostScript 2 to Create One of The Best Color Printers Yet



Tektronix is out to impress the world with its new Phaser III PXi, a plain-paper color PostScript Level 2 printer, aggressively priced at \$9,995.

The PXi is the first color printer to show off Tektronix's new phase-change ink-jet technology and one of the first to use the new color extensions in PostScript Level 2. Tektronix's phase-change technology changes ink from a solid to a liquid. The PXi uses specially designed solid ink cartridges that are melted and then jetted onto plain paper. By controlling the temperature, the phase-change technique assures that the melted ink solidifies just at the point it comes in contact with the paper. These dots are then "smashed" onto the paper through cold-pressure fusing.

In addition to this leapfrog in technology, the printer is equally impressive because it supports four devices simulta-



PostScript Level II, a RISC processor, and Tektronix's phase-change ink-jet technology are at the heart of the Phaser III PXi (originally called the PhaserJet PXi).

neously. The printer has four ports: one 25-pin serial, one Centronics parallel, one AppleTalk din 8 connector, and a SCSI port for an optional external hard disk.

It has built-in intelligence to detect which signal came in first and which page description language is being sent. You can actually have three computers hooked up to the PXi at one

time, which makes any additional printer-sharing devices unnecessary.

The PXi has an ample 1MB buffer for storing incoming data; most other PostScript printers use 100K buffers. There are 39 resident fonts; the standard PostScript 35 plus 4 that include Helvetica Narrow and Condensed.

The PXi blazed through the

FACT FILE

Phaser III PXi

Tektronix Inc., Box 1000, Willsonville, OR 97070; 800-835-6100.

List Price: \$9,995; universal tray, \$150; 8 sticks of each color, \$69; additional 4MB RAM, \$995; additional 8MB RAM, \$1,990; 8 sticks of black ink, \$119.

In Short: With its top-notch technology, this B-sized color ink jet boasts Level 2 true Adobe PostScript and HPGL compatibility. Its plain-paper capability and ability to support multiple computers makes the cost per print very attractive.

CIRCLE 707 ON READER SERVICE CARD

PC Magazine Labs printer benchmark tests. We pitted the PXi against three comparable printers: a Tektronix Phaser CP, a Varityper 600W, and an Apple LaserWriter NTX.

With normal color production work, we saw a performance gain over the LaserWriter NTX of 10 to 30 times. A test job that took only 4 minutes on the PXi took 10 minutes on a Varityper 600W and 20 minutes on a Tektronix Phaser CP.

The speed can be attributed partly to the PXi's on-board RISC processor (the AMD 29000), partly to the whopping 10MB of RAM that's standard (expandable to 18MB), and partly to the speed of PostScript Level 2 (see sidebar).

Tektronix claims the printer will print on any paper up to 11 by 17 inches—from thin drafting vellum to card stock. Our own tests proved the card stock was tough going, and had a tendency to jam, although clearing a jam was simple. Tektronix recommends that you use no greater than a 120-pound book or 0.010-inch thickness paper in the printer's standard feed tray. For heavier paper stock the printer has a top-load single sheet feed.

If you need a PostScript color output device that prints sizes up to 11 by 17 inches, this is the one. Technology and price performance make it a clear winner. Just get a sturdy table before you make your buy: The PXi weighs in at 90 pounds. ■

ADOBE POSTSCRIPT LEVEL II: Speedier, Smarter, and More Colorful

Today, if you changed your printer from a PostScript Level 1 to a comparable Level 2 device with no changes to your software applications, you would see a noticeable increase in performance.

There are several reasons, but the single most important is that Level 2 allocates memory dynamically. This means an end to PostScript limit-check errors that result from a limited stack memory in the printer.

Another important addition to Level 2 is the support

of image compression schemes. While the PXi does not currently support any of the compatible compression schemes, such as JPEG's (Joint Photographic Experts Group), you should expect to see a raft of printers and image setters with built-in compression in the next six months to a year.

Finally, PostScript Level 2 means that Adobe Systems is doing their house cleaning. All of the language extensions that have been added piecemeal over the years are fully integrated into Lev-

el II. For instance, the CMYK color model was a color extension to earlier PostScript ROM releases, but few printers ever came to market with this support. The seamless integration of CMYK into PostScript Level II means more printers will use this capability.

If you're looking for a PostScript printer today, look for Level 2 support. They're only just beginning to come on the market, but some manufacturers will begin offering Level 2 with no price increase.—GK

Our Latest PostScript Printer Technology Impressed The Experts...



MacUser,
Editor's Choice Award
(Eddy), Jan. 9, 1991



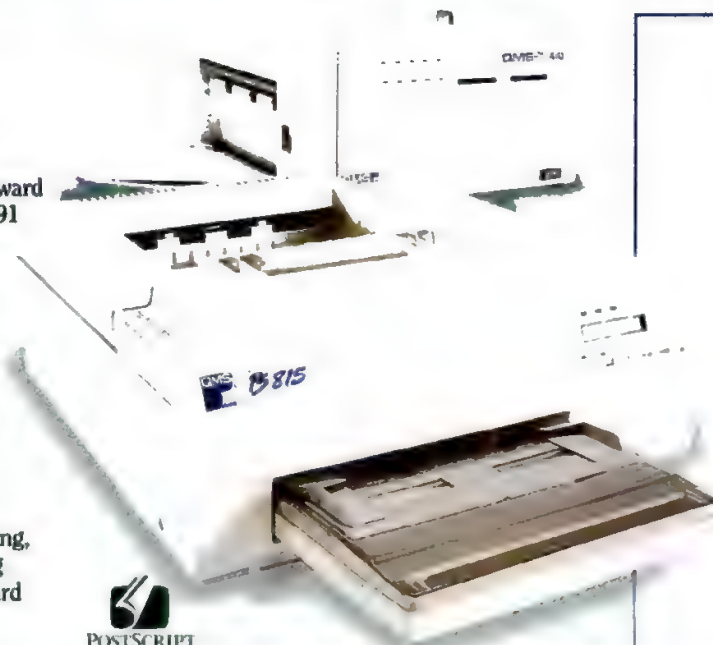
PC/Computing,
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Product,
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BYTE,
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Merit Award,
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POSTSCRIPT

...So We Decided To Give Them More Of A Good Thing.

Before we developed the QMS-PS® 410 four page-per-minute laser printer, we performed one very important task. We listened to what you wanted. Then we engineered a printer light years ahead of the rest with features that aren't available on other printers at any price.

And now, QMS brings you more of a good thing. The QMS-PS 815 and 825. Two eight page-per-minute laser printers with all the leading edge features of the 410 *plus* enhanced processing speed, an increased duty cycle and an easy-to-read, multilingual front panel that lets you quickly configure the printer to suit your specific needs.

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How did these printers capture the imagination of an entire industry? The answer is, quite literally, simple! These leading edge printers are so simple to operate they seem to "think for you." Each printer features ESP® (Emulation Sensing Processor) which allows them to interpret incoming data and automatically choose the appropriate printer language without changing switch settings or sending complicated software commands. And to make things still simpler, the 410, 815

and 825 can receive data simultaneously to LocalTalk®, RS-232C serial and Centronics® parallel interfaces, which makes them the best on the market for mixed computer environments. All this and more is the result of QMS's exclusive ASAP™ III technology (Third Generation Advanced System Architecture for PostScript). And it's this proprietary QMS® technology that wins awards *and* customers.

True Adobe PostScript Plus HP Emulations

Whether you choose the 410, 815 or 825, you'll enjoy the desktop design flexibility of the latest version of Adobe® PostScript®. This most recent version includes the output enhancement of Adobe Type Manager™ (ATM). All printers come standard with 45 resident typefaces scalable from 4 points upward and fully rotatable. These PostScript printers guarantee compatibility with thousands of useful PostScript applications currently on the market.

For even greater flexibility, these printers feature standard HP® LaserJet® Series IIP emulation to support non-PostScript printing applications. And a variety of options makes the printers easily expandable. HP-GL®

QMS-PS 410, 815 & 825 PostScript Laser Printers

- ESP - Emulation Sensing Processor (printer interprets incoming printer language and switches automatically)
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- LocalTalk, RS-232C serial and Centronics parallel interfaces (connects to IBM® PC's, Apple® Macintosh® computers and most mini computers and mainframes)
- 45 resident Adobe PostScript typefaces (all can be scaled from 4 points upward, rotatable, all with multilingual character sets)
- Front Panel Display on QMS-PS 815 & 825 (16-digit multilingual LCD array conveys printer status, allows user to quickly configure printer)
- Resident HP LaserJet Series IIP & PostScript emulations (prints PostScript & HP applications, HP-GL emulation cards available)
- QMS ASAP III Technology and 68020 Microprocessor (exclusive technology means fast first-page-out performance)
- PS Executive Series™ Utilities Software (to easily set printer parameters)

emulation cards, HP compatible font cards, memory upgrades and extended paper handling capabilities are all currently available.

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As a recognized leader in PostScript printer technology, QMS maintains a commitment to customer satisfaction by providing free, responsive technical support. And to keep your QMS printer operating at its peak, QMS National Service offers a variety of service options. Call us today and see how QMS quite simply makes the best PostScript laser printers in the world. Or FAX QMS Product Information at (205) 633-4866.

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*patent pending

Upfront Makes Short Work of 3-D Modeling, But It May Bring Your 386 to Its Knees

HANDS ON
by Jeff Prosser

Think 3-D modeling has to be hard? It isn't if you're using the new product that makes sketching and rendering in three dimensions as simple as playing with a child's building blocks.

Upfront, from Toronto-based Alias Research, made a name for itself on the Macintosh as a powerful but easy-to-use 3-D solid modeler, but it's technically not a solid modeler. It's actually a polygonal modeler; objects in the scene are composed of one or more flat polygons. Its offspring, the \$995 *Upfront for Windows*, brings the same polygonal modeling to the PC.

Designed primarily as an architect's tool, but versatile enough to fit a wide range of applications, *Upfront* makes short work of modeling buildings, homes, city streets, furniture, and other structures that can be created from blocks, walls, cylinders, and spheres.

Once the model is built, you can move the eyepoint around to get views—complete with perspective—from anywhere. Imported graphics files in a va-

riety of popular graphics formats can be used as backdrops. You can even have *Upfront* adopt the perspective viewing angles of the scenes you import—great for matching objects you create to the scenery around them.

Upfront offers a variety of options for creating objects and for adding a touch of realism to the scene. You can specify the altitude and azimuth of the sun, for example (by time, date, and latitude, if desired), and have your objects cast shadows.

You can import a .DXF drawing from a CAD program (for example, a 2-D floor plan) and use it as a template for drawing. You can add freehand brush strokes with thicknesses and shades of gray to the scene in your choice. You may group objects in layers so that portions of the screen may be viewed selectively. And with the Cut Solid command, which cuts objects where they overlap, you can accurately portray the edges defined by intersecting surfaces and perform CSG-like (constructive solid geometry) Boolean operations.

Anyone who needs to model structures in 3-D before they're

built—architects, engineers, and urban planners, to name a few—will find *Upfront* to be a valuable tool. Possible uses go well beyond the obvious, as in the case of a movie producer who uses his copy of the software to model outdoor sets and analyze shadows cast by the sun to determine what time of day to shoot.

Speed, or the lack of it, is *Upfront*'s greatest liability. Even on a 25-MHz 386 with a math coprocessor, a model that contains a couple of thousand polygons (that may seem like a lot, but it isn't in 3-D) can take up to several minutes to redraw when *Upfront*'s Resort feature, which eliminates small visual errors from the display, is enabled. Most of that time is spent in computation, so a Windows graphics coprocessor board won't help.

Adding shadows takes even longer. For optimum performance, you'll want the fastest processor you can get—with a coprocessor—and lots of RAM.

At present, *Upfront* does not include an interface to Pixar's *RenderMan*, which allows packages such as *AutoCAD* and *FastCAD* to generate lifelike

Upfront for Windows, 1.0
Alias Research, 110 Richmond St. East, Toronto, Ontario, Canada M5C 1P1; 416-362-9181.

List Price: \$995.

Requires: 386-based PC or better, 2MB RAM, Windows 3.0 or later, DOS 3.1 or later, and a mouse. (4MB to 5MB RAM, math coprocessor, and VGA or better graphics subsystem recommended.)

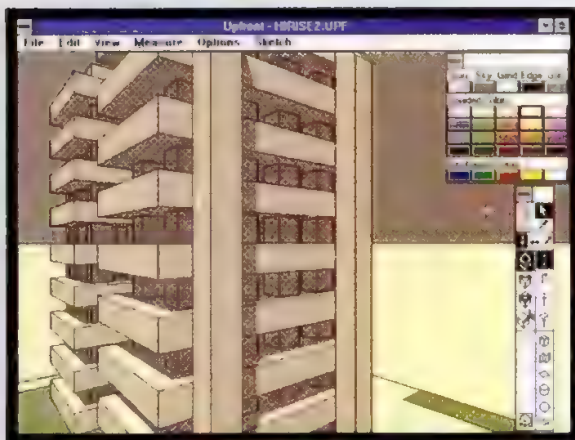
In Short: An interactive Windows-based drawing tool for sketching scenes in three dimensions.

CIRCLE 430 ON READER SERVICE CARD

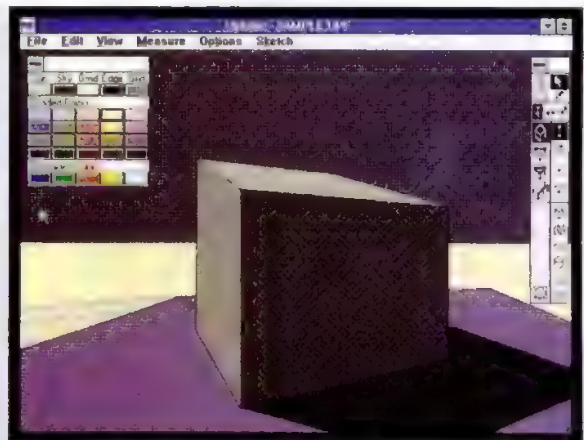
photorealistic images. If photorealistic imaging is important to you, however, you can export models from *Upfront* to *RenderMan*-supported CAD systems.

Upfront comes with several sample files and a small library of objects that you can incorporate into your own models. Its user interface is so well designed that it's a downright pleasure to use.

Once you become proficient with the package (the manual, which is well laid out and loaded with illustrations, will help get you up to speed fast), you can create even complex 3-D models in a fraction of the time that it would take with a full-blown CAD system. In the right situations, that alone should justify the purchase price. ■



Models like this one, which depicts a high-rise office building, can be fashioned in minutes with *Upfront*. Note the use of perspective to make the image lifelike.



The image above features shadows being cast by the sun. *Upfront*'s toolbox and palette windows are visible in the corners of the screen.

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Two Ways to Run a PC as Host: Digital Replaces DOS and Citrix Builds on OS/2

There are sweeping changes going on in the operating system business: IBM and Microsoft have taken separate paths, and Novell has acquired Digital Research.

But the following two products offer solutions for today that expand current operating systems. These products allow you to build a multiuser system on a limited budget.



DRMultiuser DOS

Concurrent DOS by Digital Research was the first multitasking, multiuser operating system specifically designed for IBM personal computers.

Unfortunately, it had a reputation for being quirky, and not entirely MS-DOS compatible. That reputation has changed over time: Digital Research's DRMultiuser DOS 5.0 works, and works well.

DRMultiuser DOS shares technology with DR DOS 5.0 but requires a 386SX-based machine or better. It can support up to 16 concurrent users, but this can be increased to 64 with third-party multiport drivers. Each user can have up to eight active sessions, limited only by available RAM.

DRMultiuser DOS can also be used as a multitasker for standalone systems and will support up to four graphics programs (including Windows 3.0) on the "console" or host system—again limited to available memory. Disk swapping is not supported.

DRMultiuser DOS can support only CGA or nongraphics applications on terminals because the overhead of graphics files makes the serial transfers too slow. The system can be set up with user security features that limit access to files, directories, and other resources, or left open for use as a single-user multitasker.

The task-switching menu pops up when the Ctrl-Esc keys are pressed; direct switching can be executed by pressing Ctrl and the task number. EMS

memory is allocated as needed to applications that use it; maximum amounts can be configured by the administrator.

MS-DOS compatibility was excellent when we tried the system with a number of applications. If you do encounter a compatibility problem, you can use a dual-boot option that allows you to choose between multiuser DOS or regular DOS.

Unfortunately, Digital Research chose to copy-protect the system using a printer port plug that must be present at boot time and is checked at random times during use. (There are OEM versions of DRMultiuser DOS that aren't copy protected.)

Novell's recent purchase of Digital Research may mean even more improvements to DRMultiuser DOS in coming years (see Pipeline, page 29). In the meantime, you'll find it's a stable product for multiusers and for multitasking DOS applications right now. ■

List Price: DRMultiuser DOS Version 5.0, \$695. **Requires:** 386SX processor or better, 2MB RAM plus 1MB per additional three sessions, hard disk, parallel port. Copy protected. Digital Research Inc., P.O. Box DRI, Monterey, CA 93942; 800-274-4374, 408-649-3896.

CIRCLE 706 ON READER SERVICE CARD

Citrix Multiuser

OS/2's future is still very much in question, as we all wait to see if IBM can deliver the capabilities promised for Version 2.0 (see Pipeline, June 25, 1991).

In the interim, Citrix Systems has "kept the OS/2 faith" and released Citrix Multiuser, a multiuser version of OS/2 1.21.

Citrix Multiuser lets connected PCs run one or more character-mode OS/2 programs on the host system.

It also provides access to more than four COM ports by supporting a number of multiport boards.

A dial-in connection is possible with an ANSI-compatible communications program, or with Citrix's \$99 *Multiuser Link*. You can transfer files to and from the host using the Zmodem protocol that's sup-

plied as part of the system.

The installation program is similar to OS/2's but offers some additional options. Unlike single-user OS/2, Citrix's user security system requires that the hard disk be formatted with the HPFS (High Performance File System). Once installed, the system administrator uses the CONFIG utility to set up profiles and security access.

Security is paramount in a multiuser system, and Citrix has done a good job. Four levels of access—ranging from guest to administrator—can be set on the user or group level. Individual files and directories can also be protected with explicit rights, such as read-only, read-write, or execute-only. The security system is virtually identical to LAN Manager 2.0's.

The first thing the user sees after he logs onto the system is the OS/2 Program Selector and Task Manager, identical to those in OS/2 1.0. From here, the user can run either preconfigured applications, or access full-screen OS/2 command line sessions.

Each user has a private directory on the system, accessible only by that user and the system administrator; the configuration files for the Program Selector are stored here, letting the administrator establish different menus for different users or groups.

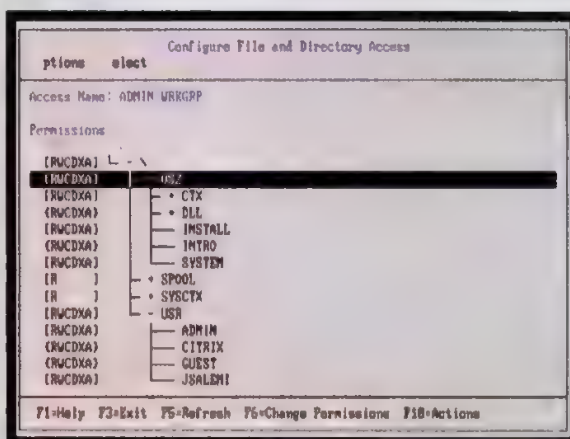
The initial package supports five users, and Citrix sells "doubler packs" to add more users.

Citrix Multiuser provides a capable alternative for those who want a non-Unix multiuser system that lets them continue using familiar DOS-style commands. Its biggest drawback is its lack of support for DOS or OS/2 Presentation Manager programs. ■

List Price: Citrix Multiuser, Version 1.0, \$995 (five users); doubler pack (doubles authorized users), \$495.

Requires: 386SX or better processor, 3MB RAM, 10MB hard disk, one high-density floppy disk. Citrix Systems Inc., 210 University Dr., #700, Coral Springs, FL 33071-9908; 305-755-0998.

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Citrix Multiuser is comprised of Microsoft OS/2 and extensions that support multiple users; a password security system is used.

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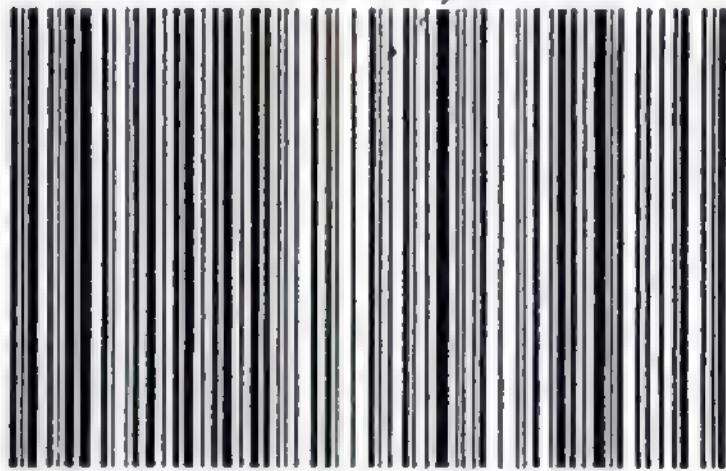
nce upon a time, you had to spend a king's ransom to possess a personal computer. In those days there lived a young rebel who dedicated himself to opposing this tyranny. He gathered about him a band of renegades and fashioned a company that sold the same quality technology directly to the people at a fair price. That company was called Gateway 2000.

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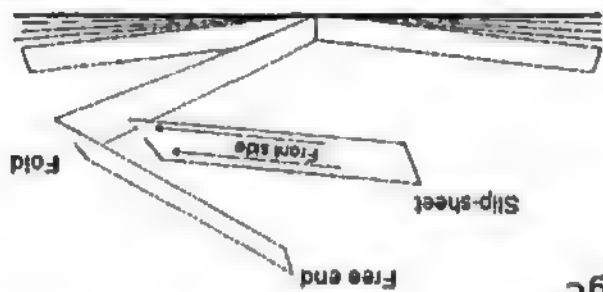
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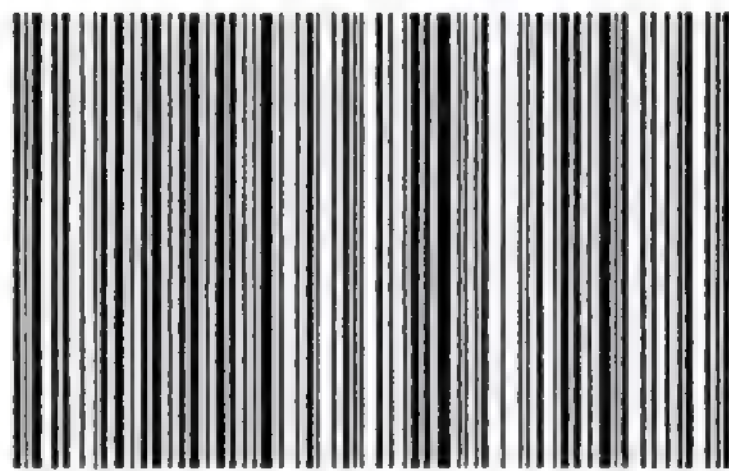
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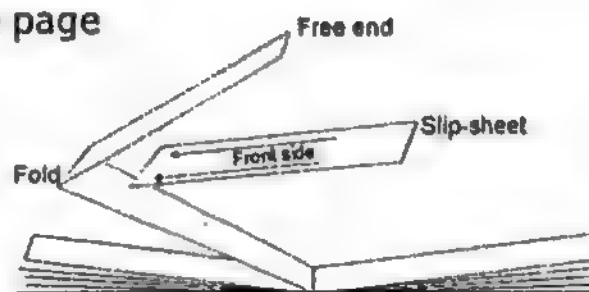
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Folded edge of the page



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Dave Russell, Director of Purchasing: "They made me play the bad guy because I'm notorious for jousting with our vendors to get the very best prices on components—good prices we pass on to you."



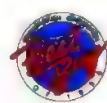
(from left, back row) Aaron Lukken, Security; Tim McCabe, Sales; Frances Chadwick, Production; (from left, middle row) Frank Gill, Shipping; Jeff Wheeler, Inventory; Thad Hollingshead, Phone Tech; (seated) Johnny Bradley, Shipping Allocator.



Bill Clemens (left), Market Research Analyst, and Mike McClendon, Market Survey Coordinator, ended up on the cutting room floor. Thanks anyway, guys!

CURTAIN CALL

The characters in our annual summer fun ad were played by a few of the 750 dedicated people who work at Gateway 2000. All photos were shot in and around our hometown of N. Sioux City, South Dakota.



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First Looks

Motorola Fastalk FAX32: First in a New Class of Data-Plus-Fax Modems



Modems that combine fax and communications functions will become prevalent in the next few months, thanks to new chip developments and an emerging set of standards for controlling modems in their fax mode.

The new \$995 UDS Motorola Fastalk FAX32 external modem is the harbinger of this breed. While there are already several data modems able to send faxes, the Fastalk FAX32 can send and receive fax transmissions, and it can also operate as a normal data modem with signaling speeds up to 9.6 kilobits per second.

The Fastalk FAX32 modem uses signaling compatible with the CCITT V.32 standards. Its processor supports the V.42bis standards for error control and data compression. Because the modem supports the V.42bis standard, it is also downward-compatible with modems limited to MNP 5.

The modem does not have the V.32bis (14.4-kilobit-per-

second) data signaling that is now available in approximately a dozen modems on the market, although UDS says an upgrade kit for the Motorola Fastalk FAX32 will eventually become available.

The modem is compatible with an emerging set of EIA/TIA standards—Group III Class I—that describe a superset of special commands in the Hayes AT command set. These commands provide a way for application programs to set up the modem for a fax call and to control the exchange of fax images.

The Class I set of standards describes the basic functions needed to originate and automatically answer a fax call, but leaves higher level image-transfer functions such as error control and binary file handling up to the software running in the PCs at each end.

An emerging Class 2 standard will call on the modem to do more of the image-handling chores, but this standard is months away from approval. Since the fax operations of the Fastalk FAX32 are largely un-



der software control, the fax software you use must be compatible with the Class I interface. The modem comes bundled with *FaxTalk Plus* software, which will allow you to send, receive, display, and print faxes.

The Fastalk FAX32's fax operations are not terrifically convenient, at least as compared with other approaches to data/fax hardware, such as the Intel SatisFAXtion board. To receive faxes you must have a TSR loaded (it occupies about 47K) while you wait for the incoming call. And you can't do anything but receive the fax during the incoming call.

While the fax operations get only a C for convenience, they get an A for reliability. Using the bundled software we were able to send and receive faxes flawlessly. You can send faxes from applications by pretending to print to an Epson FX-80 printer, or you can convert files to a fax format. We sent and received faxes to and from stand-alone fax machines, SatisFAXtion boards, and other Class I data/fax modems without a hitch.

Software vendors are beginning to incorporate the Class I standard into their products. SoftKlone promises that an imminent release of *Mirror III* will contain the Class I interface software, accessible through normal *Mirror III* menu options. In fact, we tested the Fastalk FAX32 with a late beta version of the SoftKlone software, and all was copacetic.

The modem also worked flawlessly in data mode. It connected reliably to other V.32 modems, and automatically negotiated speed, error control,

and data compression accurately. Its data pump is proprietary; its fax chip is from Rockwell.

The Fastalk FAX32 was a snap to configure, its default configuration being nearly perfect for most PC communication needs. As a bonus, its manual is not only readable, but useful, as well.

In our performance testing, the modem achieved throughput on a par with a Hayes Ultra 9600. The transfer of a 257K spreadsheet file, usually a good test of data compression, was achieved with an average throughput of 18.7 kbps compared with 18.4 kbps on the Hayes Ultra. A 105K compressed file achieved an average throughput of 8.8 kbps; the Hayes throughput was 8.7 kbps.

The UDS Motorola Fastalk FAX32 is not today's perfect data/fax solution primarily because of the inconvenient fax operation. But it is a modem that has one step up on the competition in a volatile market. As new standards like V.32bis and Class 2 appear, you can count on UDS for upgrades. If you want a V.32 modem with fax capabilities, today's Fastalk FAX32 is a solid piece of hardware and a solid value. ■

THE HAYES AT COMMANDS MEET GROUP III FAX

The Class I interface is an extension of the EIA/TIA's (Electronics Industry Association and the Telecommunications Industry Association) specification for fax communication, known as Group III. Class I is a series of Hayes AT commands that can be used by software to control fax boards.

In Class I, both the T.30 (the data packet creation and decision making necessary for call setup) and ECM/BFT (error-correction mode/

binary file transfer) are done by the computer.

A specification being developed, Class 2, will allow the modem to handle these functions in hardware.

Industry analysts believe Class 2 will be the standard for the long haul, but approval is nowhere in sight. Even so, some modem makers are ready to deliver data/fax modems later this year that they claim meet the Class 2 "recommendations." —RA



FACT FILE

UDS Motorola Fastalk FAX32
UDS Motorola, 5000 Bradford Dr., Huntsville, AL 35805-1993;
205-430-8000
List Price \$995
In Short: A new breed of fax modem that takes advantage of the Group III Class I standard.

CIRCLE 449 ON READER SERVICE CARD

PHOTOGRAPHY: THOM O'CONNOR

dBFast Generates Windows Programs from dBASE Code

HANDS ON
by Richard Hale Shaw

Many dBASE language developers have promised to support Windows; none has yet to deliver. For the moment, GenSoft Development Corp.'s *dBFast* for Windows, Version 1.55, is the only package available that can create complete Windows applications using the dBASE language—xBASE, as it's being called more and more. (See Gus Venditto's Pipeline column on page 29 for a glimpse of Borland and Ashton-Tate's plans for the language.)

The \$495 package includes a compiler, editor, linker, and simple debugger with royalty-free runtime. You can write xBASE language programs with the built-in editor, and compile and run them while remaining in *dBFast's* Windows interface.

The applications can include up to ten movable, resizable windows, browse and edit windows, push buttons, file-selection dialogs, pull-down menus, radio and check buttons and bit-maps; the *dBFast* for Windows package also supports DDE (dynamic data exchange).

dBFast's dialect of xBASE, with a breadth of over 180 commands and 170 functions, supports most of the popular xBASE commands while offering a few extensions and new commands for manipulating the Windows interface.

For instance, commands like CREATE WINDOW, CREATE POPUP, and SET COLOR TO are similar to their dBASE IV and FoxPro counterparts, but operate on Windows interface objects. @ . . . SAY . . . GET lets you create and position radio buttons. CREATE PICTURE BUTTON can use a bit-map as a push button. Multiple fonts (up to 15) are supported via an extension to the "@ . . . SAY" command. Other commands let you use list boxes, set window title and type, and even play music.

dBFast's function library is comprehensive. It includes DOS file-handling functions as well as functions for bit-wise operations and array handling. There's also support for user-defined functions (UDFs), as well.

The *dBFast* interface features a program editor that lets you open up to four files at a

time, each with up to 1,100 lines. It offers full support for the Windows Clipboard, search-and-replace (and multifile search), simple Undo, and AutoIndent.

Like most xBASE products (with the exception of *Clipper* and *Force*, which produce .EXE files), *dBFast's* compiler tokenizes your programs into a form that can be run with the runtime module. When you compile or link the program, a debug option will log errors (up to 50) and invoke the editor to display the offending source line; a similar feature exposes bugs at runtime.

Unfortunately, the *dBFast* editor can lose track of errors if you opt to add or delete source lines. More important, you cannot trace through the program as you can with program debuggers for other development languages.

dBFast's powerful DDE implementation allows your program to act as a DDE client or server, running as many as 20 simultaneous DDE conversations. So you can write a *dBFast* program that invokes *Excel* to open a spreadsheet; then you can enter data in it, and generate and display graphs from the data. As a DDE server, your program can supply data from any record in any database file, and automatically update the DDE client when a field changes or a new record is added to the database.

A full remote-server mode lets other applications use a subset of *dBFast's* commands, so they can open databases and indexes, find records, and retrieve data.

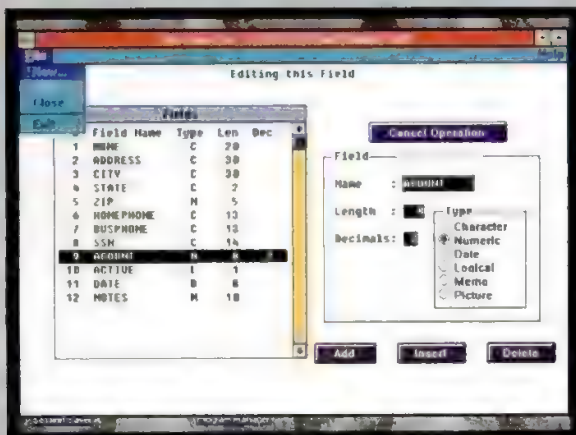
The only difficulty in making the transition from xBASE to *dBFast* stems from *dBFast's* reliance on an event-driven programming model. Unlike users of traditional DOS-based programs, Windows users need to switch windows, open files, and start new programs; *dBFast* programs have to be able to accommodate these changes.

Several functions, typically processed in multilevel case statements—EVENT(), H-MENU(), VMENU() and CHK-EVENT()—return event codes that identify the user's actions.

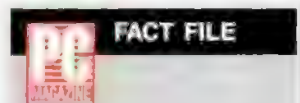
dBFast has some limitations. For instance, you cannot use macros to replace a keyword; nor is there a template facility. And *dBFast* places some unusual and terribly un-xBASE-like restrictions on the creation of integer variables. The *dBFast* interface uses pull-down menus to navigate a database, whereas *Superbase* has had handsome buttons for years. Finally, *dBFast* insists that you use numbers to refer to event codes and window types, making your programs less readable.

dBFast for Windows is not slow but it's no stellar performer, either. On small databases (up to 5,000 records), it performs comparably with dBASE IV 1.1, but on larger databases (50,000 records or more) I found that it drags.

On larger databases, *dBFast* and dBASE turn in virtually identical performances searching for records. When adding records to a database and an index, however, *dBFast* tended to run 50 percent slower. And—in no small part due to the overhead of the Windows GUI—*dBFast* ran up to 10 times slower than dBASE when displaying records. But none of this was unexpected: As with other Windows-based databases, much of the performance losses can be attributed to Windows, and until Borland can provide a Windows-based dBASE that does better, *dBFast* is still the only dBASE-compatible Windows DBMS.



With *dBFast*, you can create xBASE applications that take full advantage of the Windows GUI.



dBFast for Windows, Version 1.55

GenSoft Development Corp.,
4122 128th Ave. SE, #200,
Bellevue, WA 98006; 206-562-1157.

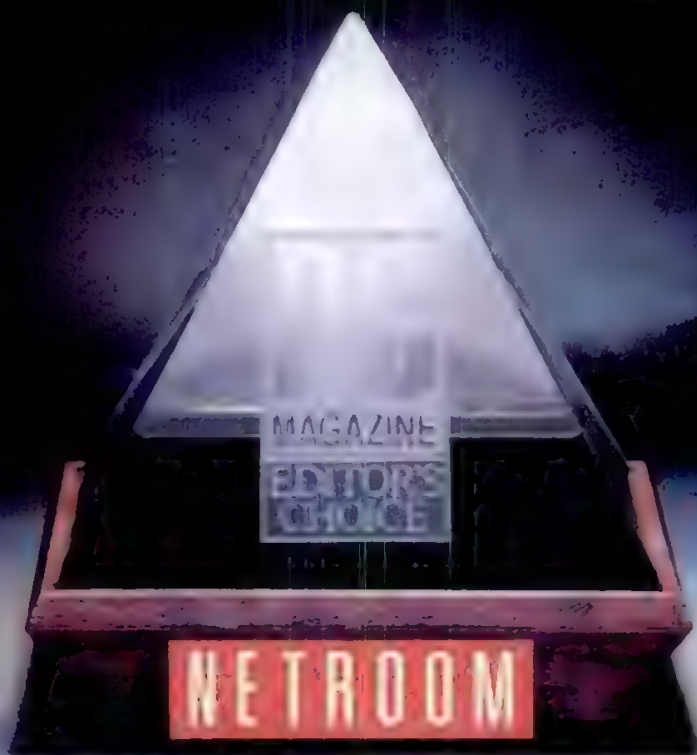
List Price: \$495.

Requires: 1MB RAM (2MB recommended), 2MB hard disk space, Windows 3.0, DOS 3.0 or later, mouse

In Short: An xBASE programmer's Windows solution, *dBFast* offers a powerful means of creating and running xBASE applications under Windows.

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First Looks

Tandy Seeks Leadership Role with Multimedia-Capable CD Drive

HANDS ON
By Gus Venditto

Tandy didn't make its name by introducing the latest technology. In the past, it had been content to provide products that appealed to the greatest number of users, after others took the risks at the leading edge.

However, with the multimedia PC offering the potential to change not just business presentations but the way people use their computers at home, Tandy is becoming aggressive.

The Tandy CDR-1000, a \$399.95 internal CD-ROM drive, is the lowest-priced CD available, and it's one of only three CDs now on the market that have the internal timing and transfer rate required in order to run the *Windows* multimedia software due out soon. The others are both by Sony: the CDU-7211 (\$949) and the CDU-541 (\$799).

The fact that the current generation of CDs are too slow to run applications that work with Microsoft's multimedia extensions (MPC) isn't good news for anyone who now owns a CD. But anyone who's been waiting for digital CD technology to reach the right price, the Tandy CDR-1000 is the right product at the right time.

The drive does have a very slow access time of 800 milliseconds, far behind the newest CD-ROMs on the market which have access times in the range of 350 ms., although at significantly higher prices than Tandy's CDR-1000 drive.

The CDR-1000's 150,000-byte-per-second transfer rate is what classifies the drive as MPC-compatible, since it means the huge data files in audio- and video-intensive applications can be brought to screen smoothly. Any access time less than one second is good enough to work with multimedia *Windows* applications.

None of the applications that run under multimedia *Windows* were ready as of this writing, so I used National Geographic's *Mammals* as a test bed. I compared the unit with a two-year-

old Sony CDU-6101.

The stopwatch wasn't needed; the difference was dramatic. The Tandy drive displayed live-action segments smoothly and realistically. On the Sony drive, the live action was jerky and marred by obvious pauses. The Tandy drive completed the video segments in less than half the time the Sony drive required.

On data access (using *Computer Select* and *Lotus Prompt* for testing), the drives fared similarly, since record searching is heavily dependent on access time.

Tandy does not use the SCSI interface that almost every other CD drive on the market uses. It created its own half-size adapter card to provide DMA access for the drive. One side benefit of this approach is that the adapter card provides left and right RCA audio outputs, in addition to the headphone jack common on other audio-capable drives.

The installation is much like any other internal disk, requiring that you have clear access to the disk and power cables. It came equipped with a set of rails; a trip to the hardware store was necessary to adapt the rails

for installation in a Compaq Deskpro 386/20.

The software installation was easy and carefully planned: It let me know what was happening, what switches were being installed in my CONFIG.SYS and AUTOEXEC.BAT files and it gave me a choice on whether to update these two files.

That's quite an improvement over the installation that other CD drives provide (and many provide nothing more than terse printed instructions). The software for playing audio disks was on a par with competitors' software.

The only drawback to this drive is that it's available only as an internal disk. If that doesn't bother you and you can settle for mid-range performance at bottom-dollar price, then don't hesitate to get ready for multimedia now.

List Price: Tandy CDR-1000, \$399.95. **Requires:** Half-height drive bay, half-size adapter slot, DOS 3.3 or later. Tandy Corp., 1800 One Tandy Center, Fort Worth, TX 76102; 817-390-3011.

CIRCLE 433 ON READER SERVICE CARD

NEC's CDR-36: The Ultimate In CD Portability

HANDS ON
by John R. Quain

NEC Technology's CDR-36, while not small enough to fit in your pocket, is comparable with portable audio CD players. A single DAC on the unit handles

audio functions. Unlike most CD-ROMs, the CDR-36 does not require a disk caddy, and it has a mini-jack for stereo headphones along with a volume control. But, it does not have separate stereo outputs for connection to an audio system.

With a rated access speed of 500 milliseconds, the CDR-36's performance is about average for CD-ROM drives. NEC includes Microsoft's CD-ROM extensions to DOS and provides High Sierra and ISO 9660 compatibility, though it is not yet compatible with Microsoft's multimedia standard.

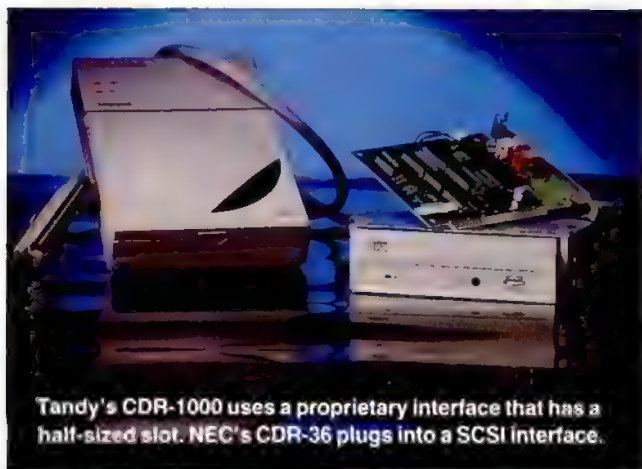
Unless you have an NEC-compatible SCSI adapter, the most reasonable route is to buy NEC's \$798 standard XT/AT interface package, which includes a CD-ROM reader, power adapter, SCSI adapter, cables, software for playing and

managing audio CDs, and miniature earphones. (A Micro Channel kit costs \$898.) The CDR-36 CD-ROM drive lists for \$599. For ultimate portability, NEC sells a parallel-to-SCSI interface connector (\$149) which plugs into a parallel port and has two connectors: a port for the CDR-36 and a pass-through parallel port for a printer, so you don't lose I/O capacity.

Software installation is automatic, and the Trantor T128 8-bit SCSI interface, which can support seven SCSI devices, is easy to install. If need be, you can set the SCSI for 0 wait-state operation and change the memory address via DIP switches. We had no trouble using the defaults on several PCs, including an XT, several ATs, and a Compaq 386/25e.

List Price: NEC CDR-36 \$599. **Requires:** DOS 3.x or later. NEC Technologies, 1255 Michael Dr., Wood Dale, IL 60191; 800-366-3624, 708-860-9500.

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CANON Bubble Jet Printer COBJ10E \$319	CMO 7C6A 1024 x 768 .28mm Dot 14" Monitor \$310	CYRIX 80387-33 Coproprocessor CXD33 \$209
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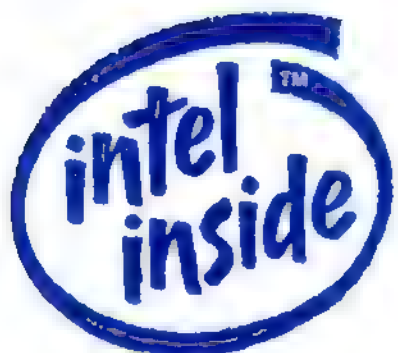
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First Looks

Mathcad Moves to Windows, Adds Symbolic Equations, Multiple Scratch Pads

HANDS ON
by Barry Simon

Mathcad has long dominated the market for mathematical scratch pads on the PC. Two and a half years since its last major upgrade, this much-awaited *Windows* version is easier than earlier versions and introduces several significant features.

Overall, *Mathcad* 3.0's refined ease of use and improved hard copy output is a direct by-product of its intelligent use of the *Windows* 3.0 interface. The single most important addition is the introduction of some symbolic manipulation and computer math licensed from the creators of *Maple*, the symbolic math program that won a *PC Magazine* Editors' Choice award.

Other additions include handbooks that allow the direct importation of "canned" formulas and graphics into your own work. Some new functions, most notably eigenvalues and eigenvectors, have also been added.

Mathcad's long-standing attraction has been its scratch-pad metaphor. The scratch pad can contain live formulas, plots, and text explanations in a single document.

The *Windows* interface dramatically improves on the scratch pad's capabilities. For example, *Mathcad* now uses the *Windows* 3.0 multiple document interface (MDI), which allows you to keep several files open, and you can easily cut and paste between documents.

In other respects *Mathcad* falls short of embracing *Windows*' conventions. Yes, moving a graph or a formula in a *Mathcad* document is as easy as selecting it with a mouse and dragging it. But in a conventional *Windows* world, double-clicking on the graph or plot would bring up a format dialog;

with *Mathcad*, double-clicking does nothing. Instead, to change the graph format, you need to select the graph and subsequently choose a menu item.

More dramatic output is possible because *Mathcad* now supports any *Windows* font, with bold, italics, and underline attributes available via a dialog box. But variables are font- and attribute-dependent, which causes confusion. It's possible to have two variables that look identical on-screen but have different values, thanks to what *Mathcad* refers to as font tags.

The addition of a *Windows*-style toolbar is an uncontested improvement. The toolbar augments *Mathcad*'s often arbitrary keystroke designations. In the previous non-*Windows* version, once you got a summation or plot template into your document, you could fill in the place holders, but you had to memorize the fact that the \$ key was called a sum template and the @ key was a plot template. These still function as accelerator keys, but now you can opt to use a mouse to click on icons repre-

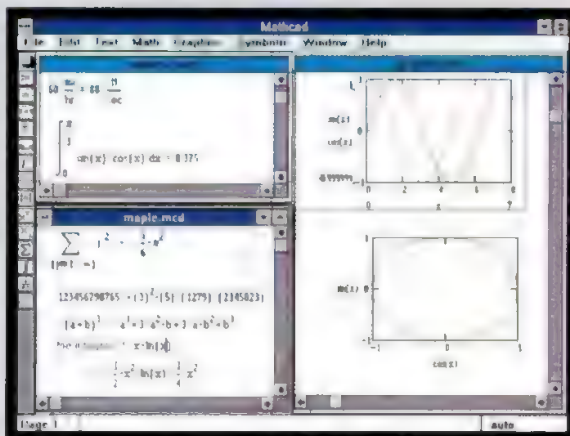
senting the summation and plot templates. The ample toolbar contains 14 icons and a button to cycle through 3 other sets of tools.

MathSoft also uses handbooks, an interesting "back door" to the *Windows* help engine. You can call a handbook into the help engine and take advantage of all the hypertext and search capabilities of the *Windows*' help facility.

The handbooks contain formulas and graphics that are marked with asterisks. When you click on an asterisk, the corresponding object is pasted into your worksheet. Two handbooks are supplied: One is a tutorial; the other contains basic mathematical formulas.

A few of *Mathcad*'s original idiosyncrasies and weaknesses are not addressed in this upgrade. The Del key, even in text typing, does the same thing as the Backspace key. The quality of the graphical output, both on-screen and to the printer, is faint. Doubling the number of pixels in an output line would be an improvement.

The most spectacular new technical feature involves symbolic math and some degree of exact rational arithmetic. Included are symbolic integration, differentiation, Taylor expansion, partial fraction expansion, factoring of polynomials and integers, calculation of determinants, and matrix in-



Mathcad 3.0 still uses its classic scratch-pad metaphor, but a new toolbar, numeric evaluations, unit conversion, symbolic manipulation, and 2-D graphs make it both easier to use and more powerful.



FACT FILE

Mathcad 3.0

MathSoft, 201 Broadway, Cambridge, MA 02139; 800-628-4223, 617-577-1017.
List Price: \$495; upgrade from any earlier version, \$99.
Requires: 2MB RAM, *Windows* 3.0 in Standard or Enhanced mode, mouse; coprocessor recommended.
In Short: The leading nonprogrammable math toolbox gets a significant upgrade to *Windows* support and adds computer algebra.

CIRCLE 700 ON READER SERVICE CARD

version.

However, the integration of these routines into the program's new *Maple* engine is less than perfect. For example, similar to a spreadsheet recalc, *Mathcad*-based calculations are automatically updated if you change a definition earlier in a document; manipulations passed off to the *Maple* engine have to be updated by hand. And while you can define a matrix by a formula for *Mathcad* manipulation, you can only do *Maple* manipulations on matrices where you've explicitly defined each element.

Mathcad's symbolic routines fall short of the array of features in *Maple*, *Mathematica*, and *Derive*. For example, Taylor series are only in one variable, and can't be extended to Padé approximants. Arbitrary precision real arithmetic is restricted to 20 digits. And missing altogether are routines to symbolically solve ODEs or recurrence relations.

Even though you can cobble together the equivalent of certain loop and branching routines, *Mathcad* has no full-featured programming language. Some feel this is a virtue because it preserves *Mathcad*'s simple interface.

Despite the imperfections, *Mathcad* is an enormously useful and broad-based tool. You may want to supplement it with *Mathematica* or *Maple* for complex projects, or use *Axum* or *Graftool* for presentation graphics, but *Mathcad* is a product that every technical professional or scientist will want. ■



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CIRCLE 148 ON READER SERVICE CARD

First Looks

Traveling Software's WinConnect Transfers Files in Windows, but It's No LapLink



Now that notebook computers routinely pack capacious hard disks into pint-sized packages, the need to move data back and forth between desktop and portable computers is more pressing than ever. And now that computer users are running *Windows 3.0*, programmers have a whole new area to explore: *Windows* utilities. There's a new generation of *Windows* utilities starting to emerge.

Traveling Software put desktop-to-laptop utilities on the map with *LapLink*; now its \$99 *WinConnect* handles your file transfers without ever leaving your comfy *Windows* environment. More important, it provides an easy way to let you access the drives on your "linked" computer as though you had one machine.

Essentially, Traveling Software's *WinConnect* establishes a client/server relationship between your connected computers. Most of the time this means that your desktop will act as the client, accessing your laptop as

the server.

With *WinConnect* running on both machines, the server's disk drives appear as local drives to the client. (So for example, drives A: and C: on your laptop might appear as drives E: and F: on your desktop.)

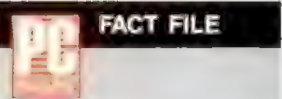
The server runs the program

from DOS, not *Windows*. The client can run from either DOS or *Windows*, but before you run *WinConnect* under *Windows*, you must first load a 62K TSR.

Because the client accesses the server drives as if they were its own, you can, for example, start a client *Windows* program that opens and save files on the server. You can also perform operations on the server such as copying, deleting, and creating directories and files. Some functions, such as DOS pipes and filters, are not supported, but you can use DIR and COPY across the link.

Unlike networked machines, *WinConnect* takes full control of the server; you cannot execute anything else on that machine while the client has access except for a Ctrl-Break, which exits the program.

The *WinConnect* box includes a 25-foot long serial cable with double heads (9-pin and 25-pin connectors) at both ends to make the machine-to-machine connection. You can use *WinConnect* in a parallel connection, but to get the cable,



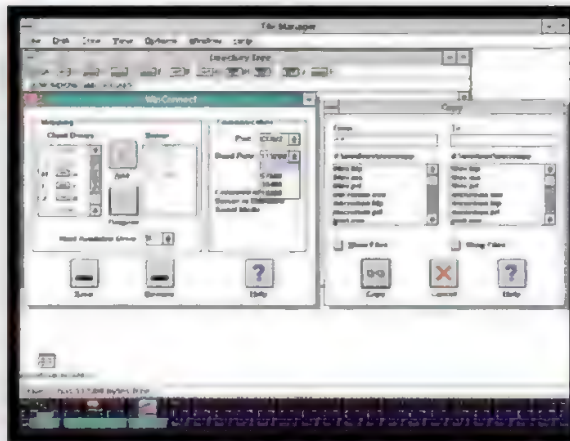
WinConnect

Traveling Software Inc., 18702 N. Creek Pkwy., Bothell, WA 98011; 800-343-8080, 206-483-8088

List Price: \$99.95

Requires: 60K available memory, *Windows 3.0* on one machine, DOS 3.x or later
In Short: *WinConnect* has a limited mission—file transfers between two hard disk-based computers operated by a single user. It has special *Windows* support, but can also work in DOS-only settings.

CIRCLE 703 ON READER SERVICE CARD



Traveling Software's *WinConnect* lets you exchange files with a connected computer using DOS's COPY command or a file enhancer utility under *Windows*. In this session, a laptop's three drives are represented by icons along the top row of the screen.

you have to order one from the company. (Traveling Software claims its cables allow an accelerated rate of transfer that you can't get from most commercially available cables.)

And to run *WinConnect* in parallel mode, you need to load the program into memory with a command line switch.

You get both 5.25-inch and 3.5-inch floppy disk formats; there isn't any need to buy two separate copies for each end of the connection.

The file-transfer features in *WinConnect* are identical to those found in hDC Corp.'s compilation of several *Windows* utilities, called *FileApps*. If you buy *WinConnect* you get the special Traveling Software cable, but if you buy *FileApps* you get a handful of other *Windows* utilities (see sidebar) but no double-head cable.

WinConnect's performance is fairly good over the serial connection for laptop hard disk access, but it's noticeably slow for floppy disks. You'll probably prefer to use floppy disk swapping rather than a *WinConnect* floppy transfer.

Traveling Software's *WinConnect* has a fairly narrow mission; it is designed for the individual who doesn't want to leave *Windows*, but needs to share information between two hard disk-based computers. *LapLink* users who are looking for a *Windows* program that can provide the same quick file transfers that they're accustomed to will have to keep waiting, at least for a while. ■

hDC'S CONNECTION: No Cable, More Utilities

You can buy *WinConnect* in two ways: in Traveling Software's \$99.95 package with a cable, or as part of hDC Corp.'s \$129 set of utilities, *FileApps*, with no cable.

The two Washington state companies shared technology in creating both *WinConnect* and *Disk Share*—the hDC utility that makes file transfers easy.

If you opt to buy hDC's *FileApps* instead of *WinConnect*, you'll get the following *Windows* utilities:

- File Enhancer Plus: file management commands, including undelete;
- File Secure: encryption and decryption, using either a proprietary or DES technique;
- Disk Viewer: a graphical view of your hard disk with tools for cleanup.

In *FileApps*, *WinConnect* is called *DiskShare*. Contact hDC Corp. at 6742 185th Ave. NE, Redmond, WA 98052; 206-885-5550.

—AP

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by
Nate Zelnick

New & Improved

News of Announced Products and Upgrades

Iomega Uses Metal-Particle Coating in 90MB Disks

NEW Iomega claims to be the first company to make use of metal-particle recording and metal-gap heads in its new 90MB Bernoulli Box disks and drives. Iomega has also significantly reduced the price of its entire product line.

The technique offers an increased linear density in recording media, as well as greater data throughput. The disks have an areal density of 60.9 megabits.

The drive can be configured to run from either parallel or SCSI-II ports with the same 14K driver. Data transfer is at 9.9 megabits per second, according to Iomega, but has a burst-mode capacity of 20 mbps.

Central Point's *Backup* is bundled with the product. That package includes the software-only version of the *Stac* data-compression algorithm. As in earlier versions of the drive, the Reed-Solomon data-integrity algorithm is



Iomega's metal-particle media drive offers 90MB of near-indestructible storage.

used; the algorithm has an error-correction rate approximately 15 times higher than standard polynomial-based systems.

List Price: Dual-drive model, \$2,249; transportable (8.4 pounds), \$1,149; inside model, \$1,099; media, \$225. **Requires:** 14K RAM. Iomega Corp., 1821 W. 4000 South, Roy, UT 84067; 800-456-5522, 801-778-1000.

CIRCLE 431 ON READER SERVICE CARD

Active-Matrix Color Portables From Sharp, NEC

NEW Following Toshiba's release of the first active-matrix thin-film-transistor (TFT) VGA color portable (see First Looks, June 25, 1991), both Sharp and NEC have announced portables with similar displays but with more powerful processors.

Sharp's 15-pound Color Star features a 10-inch-diagonal color screen with video modes of 360 by 480 pixels by 256 colors and 640 by 480 pixels by 16 colors. It's powered by a 20-MHz 386 processor with an 8-MHz sleep mode, has 2MB of RAM standard (expandable to 10MB using SIMMs), and a 100MB 17-ms. hard disk. One half-size AT expansion slot is available.

NEC's ProSpeed 486SX/C is a little heavier at 16.8 pounds, but the EISA-based 486SX/20 offers greater processor power, a 32-bit architecture, and is capable of 640 by 480 pixels by 256 colors and retails for \$1,000 less than Sharp's machine. It comes standard with 8MB of RAM (expandable to 20MB with SIMMs), a 120MB 19-ms. hard disk, and offers one 32-bit expansion slot.



Sharp's Color Star uses an active-matrix TFT VGA panel for 256 colors at 360-by-480 resolution.

List Price: Sharp Color Star PC-8501, \$9,999. Sharp Electronics Corp., Sharp Plaza, Mahwah, NJ 07430-2135; 800-237-4277, 201-529-8200.

CIRCLE 435 ON READER SERVICE CARD

List Price: NEC ProSpeed 486SX/C, \$8,999. NEC Technologies Inc., 1414 Massachusetts Ave., Boxborough, MA 01719; 800-366-3632, 508-264-8000.

CIRCLE 436 ON READER SERVICE CARD

HOT PROSPECT

FOXPRO'S RUSHMORE INDEXING TECHNIQUE PROMISES EXTRAORDINARY SPEED GAIN

Fox Software has added a query optimization technique, Rushmore, to *FoxPro* 2.0.

The patent-pending technique examines existing indexes and, if possible, pulls the desired information from them without using the database itself.

The new version also provides compound indexing, which Fox Software says will reduce some indexes to as much as one-sixth previous sizes. And it has added a "relational query by example" interface.

The new DOS-based CUA interface includes a screen painter for quick application generation, an integrated compiler, and an API that links to C or assembler; unlimited runtime licenses are also available. *FoxPro* 2.0 is fully backward-compatible with all previous versions of *FoxPro* and *dBASE*. *FoxPro Extended* (a 386-specific version, which is optimized for 32-bit computers), and the *FoxGraph* module are bundled with the package.

Rushmore can read all previous *FoxPro* indexes.

List Price: *FoxPro*, Version 2.0, \$795; unlimited runtime license, \$500; API library construction kit, \$500. **Requires:** 512K RAM (*FoxPro*, Version 2.0), 1.5MB RAM (*FoxPro Extended*), hard disk, DOS 2.0 or later. Fox Software, 134 W. South Boundary, Perrysburg, OH 43551; 419-874-0162.



In addition to performance boosts, *FoxPro* 2.0 adds a screen painter and a CUA-compliant menu structure.

CIRCLE 432 ON READER SERVICE CARD

BRIEFS



PRINTERS

Hewlett-Packard announced that it will provide free AppleTalk interface kits, including a Centronics parallel port, serial port, and AppleTalk interface, as well as Adobe PostScript cartridges to HP LaserJet IIP users who are using versions of the products designed for the HP LaserJet IIP. The enhanced PostScript control allows support for HP's resolution-enhancement technology. 208-323-2551.

Computer Peripherals is now offering new memory upgrade options for HP LaserJets, DeskJets, and compatibles. The LaserJet upgrade, called EX-pander (\$124.95 per 1MB), consist of eight 1MB 256Kx4 DRAMs, for a total increase of up to 4MB in 1MB steps. The cartridge-based DeskRAM (\$124.95) provides a total memory upgrade of 256K. 800-854-7600, 805-499-5751.

Fujitsu America has expanded its dot matrix printing line to include the DL3600 24-pin wide-carriage printer. The \$949 printer offers a company-rated draft-mode speed of 360 characters per second, Adobe PostScript support through its Windows driver, automatic paper loading, and a keyboard-based configuration with a pop-up utility. 800-626-4686, 408-432-1300.



CONNECTIVITY

Microgate Corp. is now offering the MV32 (\$999), a multifunction 9,600-bps MNP 5 V.42bis internal modem. The device, which uses the dual-FIFO 16550 UART, is capable of synchronous and asynchronous communication and conforms to system network architecture (SNA) standards for connectivity to mainframes. The product is compatible with asynchronous communications packages such as Attachmate. 512-345-7791.

Octocom Systems is shipping Release 3.0 of its modem, OSI 8x96 (\$1,195). The new model incorporates a half- or full-duplex auto-detect system that allows transparent access to older modems incapable of simultaneous independent send and receive (full-duplex) such as the Bell 208. Release 3 supports 17 modem standards, V.42bis,

CONTINUES ON PAGE 64

Scanner Resolution Enhancement Makes 800 DPI Possible

NEW Advanced Vision Research has developed a 400-dot-per-inch scanner engine and a resolution-enhancement technology that effectively doubles the scan rate.

It's providing 800-dpi scanning in two models: One is a 24-bit color scanner, the AVR 8000/CLX, and the other is an 8-bit gray-scale model, the AVR 8000/GSX.

While the combination of software and hardware AVR uses to increase resolution is proprietary, the scanners support Hewlett-Packard's ScanJet Plus drivers. Software bundling includes Micrografx *Picture Publisher*, AVR's *l/Sharp* image-sharpening package, and a Windows scanning utility. A SCSI-II interface kit is included. The optional AVR ADF 2000 100-page sheet feeder, designed for intensive OCR applications, is available for an additional \$795.

List Price: AVR 8000/GSX 400-dpi 8-bit gray scale, \$1,690; AVR 8000/CLX 400-dpi 24-bit color, \$2,190. Color upgrade kit, \$695. AVR ADF 2000, \$795. **Requires:** 2MB RAM, free expansion slot, Windows 3.0, DOS 3.0. Advanced Vision Research, 2201 Gume Dr., San Jose, CA 95131; 800-544-6243, 408-434-1115.

CIRCLE 437 ON READER SERVICE CARD

\$169 Kit Works with IBM's Extra High-Density Disk Format

NEW GSI is shipping three disk controller kits that support the 3.5-inch 2.88MB Extra-High Density (EHD) format included with IBM's new line of PS/2s (See First Looks, September 10, 1991). Kits include one drive and an EHD disk.

The three controllers (Models 1533-10, 1533-20, and 1533-21) are backward-compatible with all floppy formats and will support both 3.5- or 5.25-inch drives.

Model 1533-10 can coexist with any other disk controller to expand existing configurations. Models 1533-20 and -21 can support two or four floppy disk drives, respectively, and offer an IDE hard disk drive interface. The company claims performance rates of 1 mbps.

Included is a utility called Format 28, which corrects problems resulting from the 16-bit FAT format default of the software when using DOS 3.0 or 4.0. Format 28 rewrites the FAT to 12 bits and automatically recognizes the size of a floppy and formats it accordingly. **List Price:** Model 1533-10, \$295; 1533-20, \$419; 1533-21, \$449. Controller only: 10, \$115; 20, \$169; 21, \$199. GSI, 17951 H Sky Park Circle, Irvine, CA 92714; 800-488-7800, 714-261-7949.

CIRCLE 438 ON READER SERVICE CARD

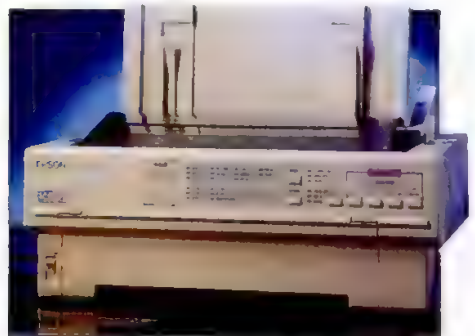
Dot Matrix Language Enhanced For Scalable Fonts

NEW Epson has enhanced its 24-pin printer control language, ESC/P, generally emulated as Epson LQ, to add support for scalable fonts.

Epson is now offering four new 24-pin printers, two narrow and two wide carriage, which use the language. The printers range in draft-mode speed from 103 to 140 characters per second, according to PC Magazine Labs benchmark tests.

The new language, ESC/P 2, brings scalable fonts from 8 to 32 points with 360 by 180 resolution to dot matrix printers. Additional new functions include a raster mode that reduces graphical computations for faster text and graphics output, a reduced-instruction page-description system, and the ability to accept compressed graphics data.

Existing LQ-compatible printers will not benefit from the change, since font support is generally built into printer ROM chips.



The LQ-870 uses Epson's ESC/P 2 control language to print scalable fonts.

List Price: Narrow-carriage models: LQ-570, \$499; LQ-870, \$749. Wide-carriage models: LQ-1070, \$649; LQ-1170, \$1,049. Epson America Inc., 20770 Madrona Ave., Torrance, CA 90509-2842; 800-289-3776; 213-782-2600.

CIRCLE 439 ON READER SERVICE CARD

Parallel/Serial Print Sharer Links Up to 16 Devices

NEW Asp Computer Products, maker of the Hewlett-Packard LaserJet print-sharing device ServerJet, has released the Port Authority line of non-LaserJet-specific printer and plotter sharers. Able to transmit data at user-configurable speeds up to 115.2 kilobits per second, the line includes 4, 6, or 12 serial ports and 4 parallel ports, each of which can be configured as input or output. All models come standard with a 256K print-spooling buffer expandable to 4MB.

CONTINUES ON PAGE 64

Borland ranked best Quattro Pro beats Lotus 1-2-3

Two recent industry studies objectively confirm the facts: Customers rank Borland best among software companies, and Quattro® Pro outperforms *all* Lotus® spreadsheets.

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APPLICATION SOFTWARE CUSTOMER SATISFACTION INDEX™

June 6, 1991

1. BORLAND

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6. LOTUS

Quattro Pro: The standard of excellence.

InfoWorld reviews confirm what more than one million PC users already know: Quattro Pro is the best DOS spreadsheet that money can buy. Better than *any* Lotus spreadsheet including their recently released version 2.3.

Just check out the *InfoWorld* review results below. Quattro Pro wins in comparison to Lotus 1-2-3® hands down in *InfoWorld* and with more than 1,000,000 enthusiastic users.

	Quattro Pro	Lotus 1-2-3	
Number of ...	3.0 ¹	v. 2.3 ²	v. 3.1 ³
"Excellent"	7	2	3
"Very Good"	8	4	5
"Good"	0	5	4
"Satisfactory"	2	5	3
"Poor"	0	1	1
Overall score	8.4	6.3	6.5

¹ Source: *InfoWorld*, April 29, 1991. ² Source: *InfoWorld*, June 10, 1991.
³ Source: *InfoWorld*, January 28, 1991.

We don't blame Lotus for trying to underplay ratings such as these, but clearly Quattro Pro is more powerful. It has better graphics, better capacity, better macros, better consolidation and linking, and much more!

Borland and Quattro Pro: The obvious choice.

Company for company, product for product, the choice is clear. Join more than a million users and upgrade to Borland's Quattro Pro today! If you own any version of Lotus 1-2-3, for only \$129⁹⁵ we'll rush you your own copy of the best spreadsheet from the best company.

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REPORT CARD			INFO WORLD
SPREADSHEET SOFTWARE			
Quattro Pro			
VERSION 3.0			
Criterion	(Weighting)	Score	
Performance			
Formulas/analysis	(100)	Very Good	
Compatibility	(50)	Very Good	
Speed	(75)	Very Good	
Database	(75)	Excellent	
Graphics	(75)	Excellent	
Output	(50)	Excellent	
Macros	(50)	Very Good	
Consolidation/linking	(50)	Excellent	
Capacity	(50)	Very Good	
Network	(50)	Satisfactory	
Documentation	(50)	Excellent	
Rate of learning	(50)	Excellent	
Rate of use	(75)	Very Good	
Error handling	(50)	Very Good	
Support			
Support policies	(25)	Very Good	
Technical support	(25)	Satisfactory	
Value	(100)	Excellent	
Final score			8.4



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CODE: MJ26

1991 J.D. Power and Associates Computer End User Satisfaction Study: Phase I. Office Based Small to Medium Sized Businesses™ Response from Business End Users at 1,784 business sites. Small to medium sized businesses were based on office sites with between 1 and 499 employees. J.D. Power and Associates is a service mark of J.D. Power and Associates. Borland is a registered trademark of Borland International, Inc. Copyright © 1991 Borland International, Inc. All rights reserved. Quattro is a registered trademark of Borland International, Inc. Pricing is in U.S. dollars. Offer good in U.S. and Canada only. Dealer prices may vary. BI 1429A
CIRCLE 285 ON READER SERVICE CARD

New & Improved

BRIEFS

CONTINUED FROM PAGE 62

and leased-line operation with automatic dial restore. 508-658-6050.

Pereline Data has announced *Pereline 3.0* (\$49.95). The communications package supports 45 modems and ISDN adapters, popular terminal emulations, and off-line graphics file viewing with auto-scaling. *Pereline's* supported file-transfer protocols include: Xmodem, Ymodem, Zmodem, Kermit, Telink, and ASCII; unsupported protocols may be added with arguments. The package supports *Windows* for multiple simultaneous sessions and background polling. 800-359-6612, 408-364-2770.



PRODUCTIVITY

Pocket Soft is now shipping *RTPatch* (\$495), a utility for updating files through comparison and replacement. It supports all file types, including executables, allowing software upgrades to be achieved by "patching on" changes to an existing file. The utility consists of two programs. Patchbld compares the old file with the update; Patch writes the changes. Patch may be distributed royalty-free with upgrade files. 713-460-5600.

Lahey Computer Systems has released Version 5.0 of its FORTRAN 90 compiler (\$595; Version 4.x upgrade \$150; previous version, \$185). The upgrade adds INTEGER*1 (BYTE) to aid code porting from mini and main-frame systems. Smaller executables can now be created with dynamically allocating arrays. Version 5.0 now also supports multilingual diagnostics, which send warning and error messages in Dutch, French, German, Italian, and Spanish as well as English. 800-548-4778, 702-831-2500.



DRIVES

Storage Plus is now offering the SS700 (\$695), a CD-ROM subsystem. The SS700 consists of a Sony SCSI-II drive and parent company Sumo System's proprietary controller and host adapter. It supports industry-standard ISO-9660 and High Sierra CD-ROMs and operates at a transfer rate of 700 kilobits per second. 408-453-5744.

CONTINUED FROM PAGE 62

A TSR allows port configuration for printer selection, multiple copy transmission, and end-of-file timeout values to be sent from the keyboard. The TSR takes up 2K of RAM.

RJ-12 serial cables, in 25-, 50-, or 100-foot lengths, are available at an additional cost of \$24, \$38, or \$65. Parallel cables range from 6 to 50 feet, and cost from \$12.50 to \$49.50. Either 25- to 25-pin or 25- to 36-pin connectors are available.

List Price: The Port Authority: PA800 (4 serial ports), \$695; PA1000 (6 serial ports), \$875; PA1600 (12 serial ports), \$1,375.

Requires: 2K RAM, available ports. ASP Computer Products, 160 San Gabriel Dr., Sunnyvale, CA 94086; 800-445-6190, 408-746-2965.

CIRCLE 440 ON READER SERVICE CARD

GRiD Makes Multimedia PCs

NEW GRiD Systems is shipping two systems optimized for the Multimedia PC (MPC) standards developed by Microsoft and others. The two machines, a 486/33 EISA and 386SX/20, come standard with a Tandy CDR-1000 CD-ROM drive and interface and multimedia expansion adapter with on-board stereo sound. The CD-1000 has a continuous data-transfer rate of 150 kilobits per second for high-quality graphics and sound information.

In addition to its 486/33 CPU and EISA architecture, the MMP 433e includes 8MB of RAM, a 105MB IDE hard disk, and a 1,024 by 768 pixels by 256-color Super VGA adapter. The 386SX/20-based MMP 320s comes with 2MB of RAM, a 52MB IDE disk, and a 640 by 480 pixels by 256-color VGA adapter.

List Price: MMP 433e, \$6,499; MMP 320s, \$2,999. GRiD Systems, 47211 Lakeview Blvd., Fremont, CA 94538; 415-656-4700.

CIRCLE 441 ON READER SERVICE CARD

Expanz! Adds Defragmenter

IMPROVED InfoChip Systems' Expanz! data-compression system has added support for bootable partitions, a defragmenting utility, and has fixed previous incompatibilities with undelete utilities (including *PC Tools Deluxe* and *The Norton Utilities*). In addition, it now comes bundled with Multisoft's *Super PC-Kwik* disk-caching software. These changes permit real-time compression without the need for a separate compression partition, according to the company.

List Price: Expanz! Plus, \$199. **Requires:** 32K RAM, open AT slot, DOS 3.0 or later. InfoChip Systems Inc., 2840 San Tomas Expwy., Santa Clara, CA 95051; 800-447-0200, 408-727-0514.

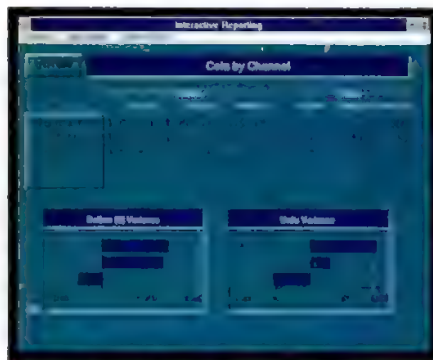
CIRCLE 442 ON READER SERVICE CARD

EIS Update: Pilot and Forest & Trees Add Features

IMPROVED Two programs that provide executive information system (EIS) features have been upgraded.

Pilot Executive Software's *Lightship 3.0* now supports DDE (dynamic data exchange) and DLLs (dynamic link libraries) for more comprehensive data access. A new add-on product, *Lightship Lens*, provides quick data links to ASCII, dBASE, Paradox, SQL Server, and Oracle Server data through additional DLL-based viewers. Other changes include support for 256 screen colors, new charts, faster scrolling, and WYSIWYP (what you see is what you print) screen to printer control. Drill-down searching, the ability to navigate through related data by query, has also been improved.

Channel Computing's *Forest & Trees* has also substantially improved its drill-down features with user-definable triggers that define point-and-click relationships between dynamically linked applications. Other enhancements to Version 2.0 include an updated SQL query mode, which now offers full support for all SQL commands, improved viewers for *Lotus 1-2-3 3.x*, *Microsoft Excel 3.0*, and *Btrieve*, among others, and an application development tool for creating ad-hoc query views. An improved desktop allows you to store information in group folders and view in table modes; it also adds *Windows 3.0* and third-party font support.



Lightship 3.0's branching DDE hot links creates compound data views from multiple sources.

List Price: *Lightship*, Version 3.0, \$795; *Lightship Lens*, \$195. **Requires:** *Windows 3.0*. Pilot Executive Software, 40 Broad St., Boston, MA 02109; 617-350-7035.

CIRCLE 443 ON READER SERVICE CARD

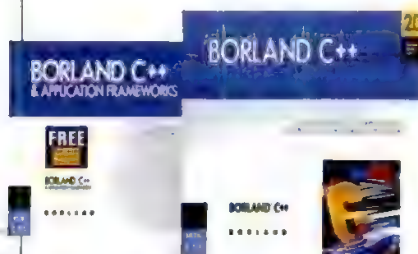
List Price: *Forest & Trees*, Version 2.0, \$495; client/server edition, \$1,495; network node pack, \$395. **Requires:** 2MB RAM, *Windows 3.0*. Channel Computing, 53 Main St., Newmarket, NH 03857; 603-659-7590.

CIRCLE 444 ON READER SERVICE CARD

CONTINUES ON PAGE 66

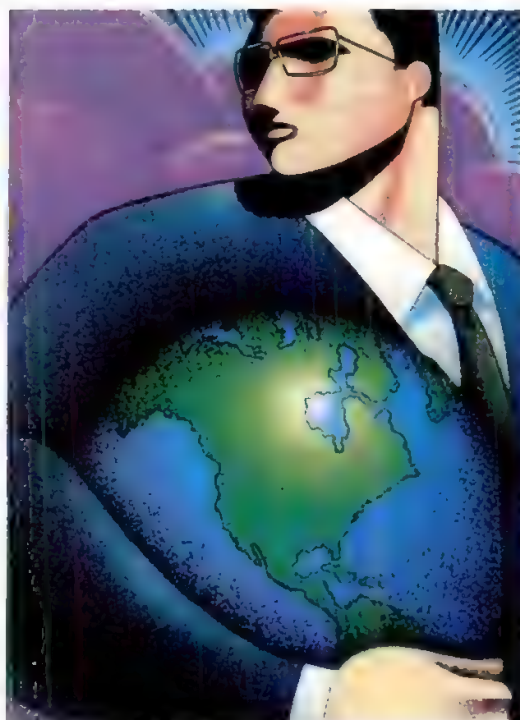
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Borland C++ conquers Microsoft C



Borland C++ is the professional's choice for C and C++ development. Tests conducted at the independent InfoWorld labs prove the superiority of Borland C++. For mission-critical applications, Borland C++ gives you the excellence you need.

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The built-in ObjectWindows™ application framework streamlines Windows development. It automates initialization and gives your applica-

tions more functionality with less code. ObjectWindows features Borland Custom Controls that make your applications look great.

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When you buy Borland C++ you get more than just the best C and C++

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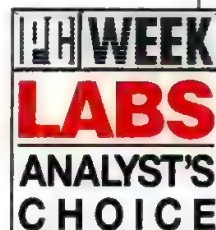
faction, in Small and Medium Sized Businesses."* And PC Week honored Borland C++ with their analyst's choice award, stating "Borland's Windows tools are excellent, both individually and in their smooth integration into a convenient development cycle... Borland offers the strongest solution for C++..."

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InfoWorld Report Card		January 7 1991
	Microsoft C	Borland C++
Version	Version 6.0a	Version 2.0
Price	\$495	\$495
Programming environment	Excellent	Excellent
Language extensions	Very Good	Excellent
Debugging	Very Good	Excellent
Documentation	Satisfactory	Excellent
Ease of use	Good	Excellent
Value	Very Good	Excellent
Final score	7.3	9.3

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CIRCLE 295 ON READER SERVICE CARD

New & Improved

BRIEFS

CONTINUED FROM PAGE 64

Miltope Corp. has announced the availability of the CR-500 (\$2,000 to \$20,000), solid-state disk, based upon Intel's Flash memory, available in 20MB to 80MB configurations. The 5.25-inch half-height drive can be configured for serial, parallel, or embedded SCSI interface and, in the SCSI version, can emulate a tape backup system. Access time is under 100 nanoseconds and, because of the solid-state design, the disk has a higher file-transfer rate than any existing hard disk, according to Miltope. 516-420-0200.

MicroSolutions is now shipping the Backpack hard disk drive (40MB, \$650; 80MB, \$850; 120MB, \$995). Aimed at storage expansion for laptops and notebooks, the drives use a pass-through parallel port connection (printers or other parallel devices attach to the back of the connector) and consequently don't require a disk controller. The drive has a 3.5-inch form-factor device and is bundled with installation software. 815-756-3411.



LAPTOPS

Librex Computer Systems.

A U.S.-based subsidiary of Nippon Steel, has begun shipping a 6-pound, 2-by 11.7-by 8.4-inch (HWD) 20-MHz 386SX notebook (\$4,895). It offers a 9.5-inch backlit, 640 by 480, 16-shade gray-scale VGA screen with auto-reverse. Other standard features include two serial, one parallel, and one video-out port; 82-key keyboard with embedded numeric keys; 1.44MB 3.5-inch floppy disk drive; and 1MB of RAM (upgradable to 3MB). The 20MB hard disk is upgradable to 40MB or 60MB. A \$3,150 286-based model is also available. 408-441-8500.

Magnavox is now offering a 6.8-pound 16-MHz 386SX notebook (\$3,199). The Metalis/SX offers a sidelit 8.65-inch (diagonal), 32-shade gray-scale VGA screen, 1MB RAM (upgradable to 5MB), a 29ms, 40MB hard-drive; 1.44MB 3.5-inch floppy disk drive; serial, parallel, and video ports; and a 2,400/9,600-bps data/fax modem. The removable nickel cadmium battery provides an estimated 3 hours of battery life, according to the company. 800-722-6224, 213-217-1300.

Collage Prints Captured Screens

IMPROVED *Collage Plus*, Inner Media's Windows- and DOS-based screen-capture utility, has added the ability to print captured screens quickly from the DOS-based SHOW program. The quick screen dump enhances page makeup for desktop publishing applications by creating draft-quality images in approximately 12 seconds.

Version 3.2 allows Windows screen cropping and capturing of pull-down menus. A timer feature allows capture of an active Windows cursor. The ability to save images directly to the Windows Clipboard and on-line documentation through Windows Help have also been added.

List Price: *Collage Plus*, Version 3.2, \$129.

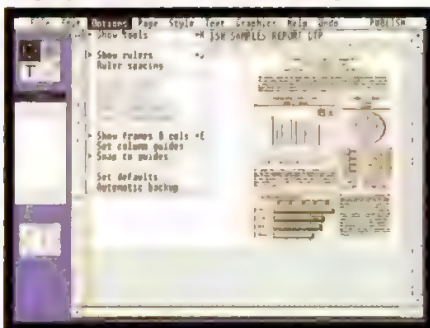
Requires: 60K RAM, DOS 2.0 or later, for DOS version; Windows 3.0 for Windows version. Inner Media, 60 Plain Rd., Hollis, NH 03049; 603-465-3216.

CIRCLE 446 ON READER SERVICE CARD

Publish It! Adds Text Wrap, New Fonts

IMPROVED *Publish It!*, Timeworks' GEM-based low-cost desktop publishing system, has added a text-manipulation feature that automatically wraps copy around or inside irregular shapes. Additional changes include eight new Typografica scalable fonts (6 to 72 points), extended and expanded memory support, custom page sizing up to 22.5 inches (height or width), and automated backup.

Also added to Version 2.0 are object selection, import of Microsoft Word 5.5, Microsoft Works 2.0, and DCA/RFT file-format compliant programs such as Word for Windows, DisplayWrite, and Lotus Manuscript.



Timeworks' GEM-based Publish It! has added eight typographic fonts and a text-wrapping utility.

List Price: *Publish It!*, Version 2.0, \$249; upgrades, \$49.95. **Requires:** 640K RAM, DOS 3.0 or later. Timeworks, 625 Academy Dr., Northbrook, IL 60062; 800-323-7744, 708-559-1300.

CIRCLE 448 ON READER SERVICE CARD

Low-Cost CAM Prototypes From CAD Files

NEW If you want to prototype quickly or build objects with CAD software, Techno's MasterCAM system provides a low-cost entry into computer-aided manufacturing. The software translates CAD files for a controller that drives the Techno Axis Gantry Positioning System, the box where the manufacturing takes place. A number of cutting tools, including a wood/plastic router, variable-speed spindle and engraving head, can be fitted to the gantry to create different surfaces or depths. The system is accurate to .0004/inch.

The system translates .DXF, IGES, CadKey, Anvil, or ASCII Data Point files into MasterCAM's motion-description language, which drives the tool. The software automatically compensates for the material being worked, based upon a tolerance list. Any material weaker than the tool head can be worked. A number of Gantry Positioning Systems, varying in height from 3.9 inches to 11.8 inches, are available. Maximum width is 4 feet. Both 2-D (for engraving) and 3-D systems are available.

List Price: MasterCAM, 9.8- by 15.7-inch 2-D, \$8,801.72 (lowest end); 48- by 49-inch 3-D (highest end), \$16,094; wood/plastic router, \$790; variable-speed spindle, \$350; engraving head, \$1,750. **Requires:** 286 or better, 640K RAM, 20MB hard disk space, math coprocessor. Techno, 2101 Jericho Tpke., P.O. Box 5416, New Hyde Park, NY 11042-5416; 516-328-3970.

CIRCLE 447 ON READER SERVICE CARD

PC-to-Mac Package Runs VGA

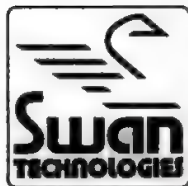
NEW Argosy Software has combined three Mac-to-PC connectivity packages to share files between the two platforms. RunPC/Network consists of MountPC, Software Bridge/Mac, and RunPC and is compatible with extended and expanded memory, VGA, and the Mac's System 7.0. DOS programs run on the PC and can be viewed and controlled on Macs.

It also can capture any PC graphic; it has support for over 30 Mac and PC word-processing formats, DOS disk support on Macs with the Apple SuperDrive, and printer-sharing with any Macintosh printer.

The package runs on any Mac with a PC connected either through a modem or to an AppleTalk network. The basic package links a PC to 10 Macintoshes. A serial/modem-only product, RunPC/Remote, is also available. ■

List Price: RunPC/Network, Version 1.0, \$445; RunPC/Remote, Version 1.0, \$219. **Requires:** Macintosh, DOS 2.0 or later, 40K RAM. Argosy Software Inc., 113 Spring St., 5th Fl., New York, NY 10012, 212-274-1199.

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Survey, 9/25/90



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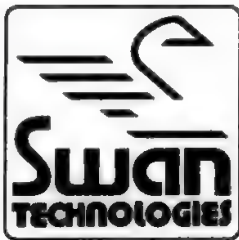
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50MB (17mb)IDE	\$1395	\$1445	\$1595	\$1795
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330MB SCSI (16ms)	\$2595	\$2645	\$2795	\$2995
330MB SCSI (16.5ms)	\$3195	\$3245	\$3395	\$3595
400MB IDE (12.5ms)	\$3395	\$3445	\$3595	\$3795
400MB SCSI (12.5ms)	\$3495	\$3545	\$3695	\$3895
660MB SCSI (16.5ms)	\$4095	\$4145	\$4295	\$4495

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100MB IDE (17ms)	\$2195	\$2245	\$2395	\$2595
220MB IDE (12.5ms)	\$2695	\$2745	\$2895	\$3095
400MB IDE (12.5ms)	\$3495	\$3545	\$3695	\$3895
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- 8) 16-Bit Expansion Slots
- Enhanced 101-key Keyboard
- MS-DOS v5.0

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Drive Options	Video Options Include Monitor & Video Adapter			
	12" Mono	14" Flat Mono	VGA Mono	1024 VGA
100MB IDE (17ms)	\$2695	\$2745	\$2895	\$3095
220MB IDE (12.5ms)	\$3195	\$3245	\$3395	\$3595
330MB SCSI (16.5ms)	\$3795	\$3845	\$3995	\$4195
400MB IDE (12.5ms)	\$3995	\$4045	\$4195	\$4395
400MB SCSI (12.5ms)	\$4095	\$4145	\$4295	\$4495
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100MB IDE (17ms)	\$3695	\$3745	\$3895	\$4095
220MB IDE (12.5ms)	\$4195	\$4245	\$4395	\$4595
330MB SCSI (16.5ms)	\$4995	\$5045	\$5195	\$5395
400MB IDE (12.5ms)	\$4995	\$5045	\$5195	\$5395
400MB SCSI (12.5ms)	\$5295	\$5345	\$5495	\$5695
660MB SCSI (16.5ms)	\$5895	\$5945	\$6095	\$6295

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—Computer Shopper, 10/90

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Daniel Morgan
PC Magazine
9/25/90



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Quality computers are built with quality components. When you purchase a Swan computer, you can be confident that you are in fact getting only the highest-quality components. Swan selects from industry-leading manufacturers like Conner Peripherals, Teac, Quantum, Sony, Hewlett Packard and Intel. Bill Machrone, Editor-In-Chief of PC Magazine, said it best after a visit to our manufacturing facility,



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—PC Magazine, 9/11/90

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edited by
Matthew J. Ross

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Reviews of the Latest Books for the PC User

Jim Seymour's Home-Grown Business Productivity Tips

If you've been wondering why your PC makes you work harder, not smarter, you have a lot in common with *PC Magazine* contributing editor Jim Seymour, who spends a fair amount of his time helping the Fortune 500 companies work more productively with their PCs.

In his *PC Productivity Bible*, Seymour has gathered some 100-plus of his best PC tips, tricks, and techniques, written a short two- or three-page chapter about each one, and then sorted them by topics that range from documents to databases, from spreadsheets to systems. Seymour's topology makes the book accessible to many levels of PC users. If one tip is not right for you, it's easy to skip to ones that are.

The best parts of the book are those where Seymour passes on those gems—little tips that are so obvious you could kick yourself for not thinking of them first.

For example, when you want to use the numeric keypad on the fly, do you always remember to hit the NumLock key first? And then to hit it again when you need the arrow keys? There ought to be an easier way to punch in an occasional number, right? Well, there is. Just hold down the Shift key while entering numbers.

Seymour offers a tip that may save you more than just time; twice it helped him recover a missing laptop. How did Seymour get his equipment back? He put a "Reward if found! Please return to..." plea in his AUTOEXEC.BAT file.

The *PC Productivity Bible* also passes along some of Seymour's own software preferences. The book includes mini-reviews



of *MemoryMate* and *GrandView*, two personal information managers (PIMs). And a chapter on General Information's *Hot Line II*, a \$99 telephone dialer that Seymour dubs his "most important productivity tool."

In a world of upgrade mania, Seymour tells how to spot the software upgrade that may turn counterproductive, as he wonders aloud whether every user really needs each new bell and whistle that comes along. Seymour himself pleads guilty to harboring a two-year-old spreadsheet. All in the name of productivity.

Seymour has written a business book that talks about computers, rather than just another computer book. If you read his column, you know that when Seymour talks computers, he

Don't Tell Me What the Computer Says

In his book, Jim Seymour relates the comments of one Fortune 500 executive discussing how PCs change the way people work:

"The one thing I really hate about computers in general," says the executive, "is how they encourage people to come in and tell me what the computer says."

"I don't give a damn about what the computer says! We bought these computers for people to use to become better managers. I don't want to know what the computer says; I want to

know what he says."

In a few sentences, he cut to the heart of how computers, especially PCs, are used and misused in large companies. These are decision-support systems, not decision-making systems. They can make us far more powerful, more effective, by helping us tap into more sources of information, consider more options, quantify the heretofore unquantifiable. But computers don't make decisions, they just process information. —Jim Seymour's *PC Productivity Bible*, page 117.

means business. Seymour's straight-shooting column style carries over into the *PC Productivity Bible* which, if not quite biblical in scope, may still be dubbed the "good book" of personal computer productivity. —John Woram

Jim Seymour's PC Productivity Bible

by Jim Seymour, \$24.95, A Brady Book, Simon & Schuster Inc., 15 Columbus Circle, New York, NY 10023; 212-373-8093. ISBN 0-13-511080-7.

CIRCLE 421 ON READER SERVICE CARD

Two Books Teach Corporate Beginners To Excel with Rows and Columns

Microsoft Excel 3.0 is a highly visual program, but it is also complex. Many of its features fall into the category of "it's intuitive once you know it." Even seasoned spreadsheet veterans will need to spend some time learning the program.

Microsoft supplies surprisingly little help as part of the *Excel* package. Sure there is an automated tour of the program's features and a thin 80-page "Getting Started" booklet that runs you rapidly through a variety of exercises, but these offer little explanation of the process or alternatives available. Two new books, *Microsoft Excel Step by*



Step and Mastering Excel 3 for Windows, can help get you started.

Microsoft Excel Step by Step comes with the impressive subtitle, "The Official Microsoft Excel Courseware." Part of the Microsoft Press "Step by Step" series of books, it is designed for use either by individual users or as a text for classroom courses; corporate discounts are available.

The book is well organized with topics that follow a logical progression, moving from worksheets to printing, databases, charts, and macros. Roughly 270 pages long, *Excel Step by Step* includes

a 5.25-inch disk. The disk contains all the files needed for each lesson; if you fail to complete one chapter correctly, the disk still provides you with a clean file for the next chapter.

Each chapter contains a clear statement of objectives, an appropriately conservative estimate of the time it will take to complete, and a summary at the end to recap your progress. The lessons are well illustrated and point out both the mouse and keyboard commands needed to perform the various operations.

There are some problems, however. *Excel Step by Step* does not start at the beginning but rather recommends that you first run through the *Excel* tutorial. The section on launching *Excel* from *Windows* will baffle most beginners, since it makes a num-

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* Manufacturer's Suggested Price (MSP) for 20MB configuration.

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ber of bold assumptions about how Program Manager is configured on your PC. Installation instructions for copying the practice files to a subdirectory are sketchy, and at least one macro failed to run correctly since it was hard-coded to look for files on drive C: (which won't work if your *Excel* files are somewhere else, such as drive D:).

With almost no discussion of good spreadsheet design or of *Excel*'s built-in functions, the book just doesn't go deeply enough into the program. But it does an excellent job of cross-referencing its content to *Excel*'s own documentation.

Microsoft Excel Step by Step is too difficult for the novice and

a power user won't be satisfied with it for long. The book is best suited for the broad group of people who are already working with computers, who will be using a small proportion of the program's capabilities, and who need survival skills to help them get their work done.



Mastering Excel 3 for Windows from Sybex Computer Books covers similar ground with a totally different style. Author Carl Townsend starts earlier and goes farther than the Microsoft Press book, but the ride is a little bumpier along the way.

To begin with, *Mastering Excel 3* is twice as long—more than 550 pages. It follows a similar outline, covering worksheets, databases, multiple documents, printing, graphics and charts, and macros. The book is more useful to rank novices,

however, since it starts with fundamental instruction on how to use *Windows* and provides a good overview of *Excel*'s features. It also provides more thorough information and useful nuggets, such as how to use the Ctrl-; and Ctrl-: keystrokes to enter the current date and time into a spreadsheet. Townsend also includes a useful (albeit brief) discussion about good spreadsheet design.

Mastering Excel 3 does have some weak points. Many chapters grind to a halt without summarizing what's been covered or making a transition to the next chapter. Even more serious is the fact that you are asked to create sample worksheets, but the data is not included in the text. Instead, you are asked to copy the information from the screen captures that are reproduced in minute 5- or 6-point type. With no companion disk, your only avenue to the exer-

cises is to squint and peck.

For all its shortcomings, however, *Mastering Excel 3* is a good choice for someone who plans to work a lot with *Excel* and wants more than just a once-over-lightly. If you are new to *Windows* and *Excel*, this book will start where you are and carry you about as far as you want to go.—Alfred Poor

Microsoft Excel Step by Step

by Microsoft Corp., \$29.95, Microsoft Press, 16011 NE 36th Way, P.O. Box 97017, Redmond, WA 98073-9717; 800-677-7377, 800-888-3303. ISBN 1-55615-319-8

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Mastering Excel 3 for Windows

by Carl Townsend, \$27.95, Sybex Computer Books, 2021 Challenger Dr., Alameda, CA 94501; 800-227-2346. ISBN 0-89588-643-X.

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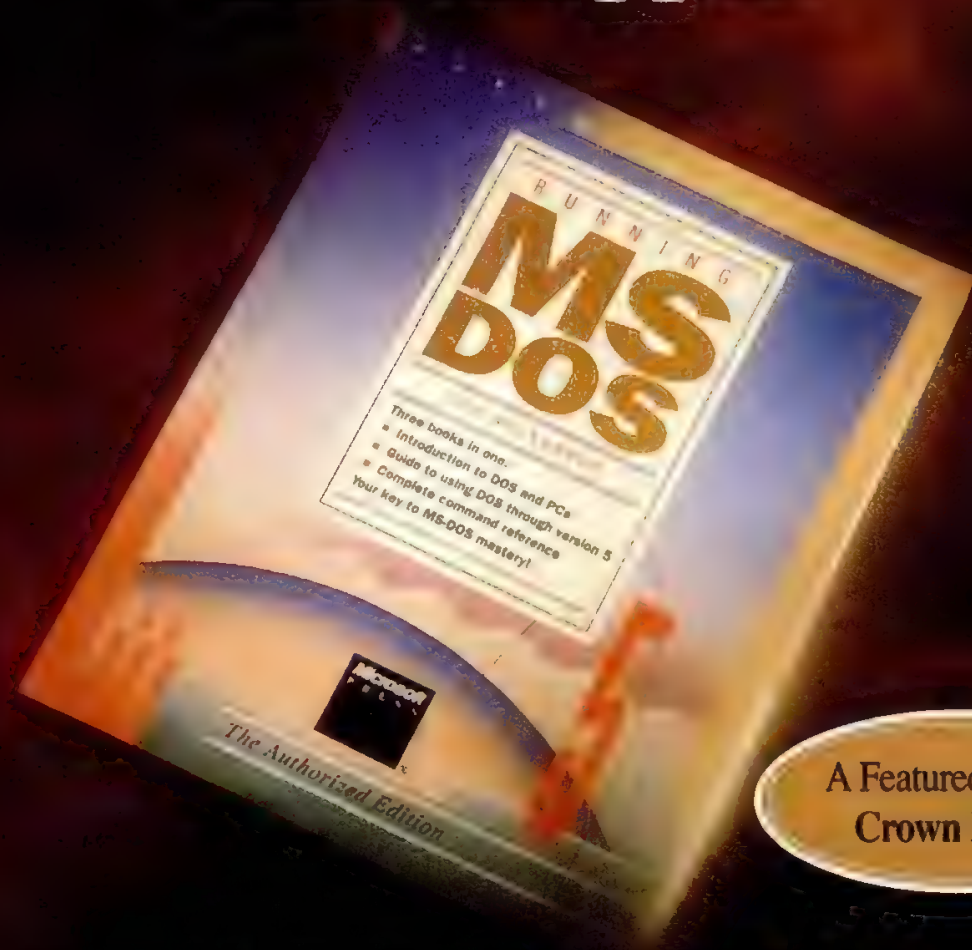
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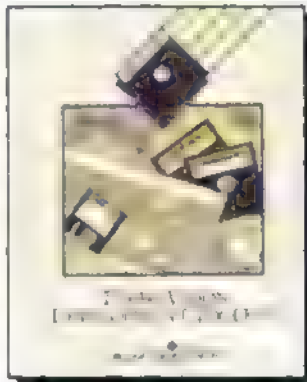
edited by
Trudy Neuhaus

Toolkits

Reviews of the Latest Tools for the PC Programmer

Blaise's Toolkit Speeds Development Of Turbo Vision Applications

Borland's Turbo Vision (TV), introduced with Turbo Pascal 6.0, is a library of objects that form a complete application framework for Turbo Pascal programs. TV speeds creating a user interface, leaving you more



time to concentrate on the rest of your program—in theory, anyway. In practice, writing the code for a large TV menu is a nightmare of nested parentheses. And although TV provides all the standard controls for dialog boxes, you have to size and place each by trial and error—a tedious task.

Enter Blaise Computing's Turbo Vision Development Toolkit. TVDT immensely simplifies the process of developing Turbo Vision applications. Its Resource Editor lets you devise menus and dialog boxes visually and store the results in a resource file. Then, using its *Windows Script File Generator*, you translate the TV resource file into a script that defines a parallel resource file for *Windows*. Finally, a set of extensions to the TV objects enhance applications with automatic resource file support, debugging aids (easily removed for production versions), and more.

THE RESOURCE EDITOR

With RESEDIT.EXE, you can create and edit three types of resources: menus, string lists, and dialog boxes. RESEDIT contains a separate editor for each type.

The *Menu Bar Editor* displays an entire menu in outline form. It's a snap to insert new menu items or submenus, or to change the hotkey, command number, help context, or menu level for an item. Moving individual items is also simple, though the editor

doesn't yet support moving entire submenus. At any time, you can enter Test mode and try the latest version of your menu. And if you name the menu bar with the name of your program plus _MB, the extended application

objects will load it automatically.

The most common use of the *String List Editor* will probably be to supply "hint text" for menu items and other on-screen objects. A TV status line displays a one-line "hint" string that changes according to the current help context. All you have to do is match the string list, via its numeric key, with the help context of the corresponding menu item or dialog control. Name the string list resource with the program name plus _HT, and the extended application will automatically use it for hint text. String lists can also make a program language-independent; if every text string resides in a string list resource, changing languages is as simple as selecting a new resource.

The *Dialog Box Editor* is the most complex of the three. It displays a blank dialog box which you can interactively customize. For example, you can stretch and move the box, or enter text to give it a name.

Six kinds of controls are available from the Dialog Box Editor menu: Push Button, Radio Button, Check Box, Input Line, Static Text, and List Viewer. When you select one of these controls and insert it into a dialog box, it will automatically appear in the upper-left corner; you then move and size it to suit your taste. If you later resize the dialog box, the controls stay in place relative to the upper-left corner. Dialog

controls can have help contexts, too, and it's easy to assign them in the dialog editor. Note that if you assign the number 2000 to a cluster of radio buttons or check boxes, Turbo Vision will assign the individual items help contexts of 2000, 2001, 2002, and so on.

In a TV program, repeatedly pressing the Tab key highlights the various controls of a dialog box in order. The dialog box editor lets you adjust this order using an enhanced list box. In this "swap box," you simply drag the items into the desired order. Tab order is also the order in which the dialog box moves data into and out of its controls, so TVDT builds an Include file containing an appropriate data structure.

Some Turbo Vision programs will use descendants of the basic control types for enhanced and specialized features. RESEDIT can't know about these user-defined types in advance, so it allows you to Shoehorn a descendant of any of the basic control types into a dialog box. This complicates your source code, but you won't have to do it often.

WINDOWS SCRIPT FILE GENERATOR

Like *Windows* applications, TV programs are event-driven. You can't write an application that will run under both DOS and *Windows*, but with RC-1.EXE (pronounced "RC Inverse") TV and *Windows* programs can effectively share resources. RC-1 takes a TV resource and translates it into a series of instructions for the *Windows* Resource Compiler (RC). The relative size and position of the elements remains as much the same as the transition to graphics mode allows.

EXTENDED APPLICATION OBJECTS

One of the strengths of OOP is easy extension of existing ob-

jects. Blaise has extended the main TV application object not once but twice. Their bTApplication object automatically opens a program's resource file, and if you've followed correct naming conventions, loads the menu bar and hint text from that file. Simple method calls invoke new features such as a DOS shell, extended help system, recording and playback of events, and objects that monitor heap usage, events, and general memory usage.

By changing the unit name bApp to BetaApp in your source code, you can choose a "beta" version of the extended main application. This version adds a β menu that gives immediate access to all of the bTApplication's special abilities. When your testing phase is over, change the unit name back for a production version. Of course, your production version can incorporate any or all of the specialized features.

TVDT comes with complete source code, not only for the extended objects but for RESEDIT itself. Naturally, RESEDIT is written using TVDT resources and the Blaise extended objects. The manual's style is near-identical to that of TV, which is both a blessing and a curse. The layout will be familiar, but if you don't carefully peruse the *entire* reference section, you're likely to miss some of the enhancements. Just remember: Any feature you see in RESEDIT can belong to *your* program too!

—Neil J. Rubenking ■

Turbo Vision Development Toolkit, Version 1.0.

List Price: \$149; **Requires:**

Borland's Turbo Pascal 6.0; DOS 3.0; 512K RAM. Blaise Computing Inc., 819 Bancroft Way, Berkeley, CA 94710; 415-540-5441; 800-333-8087 (orders only).

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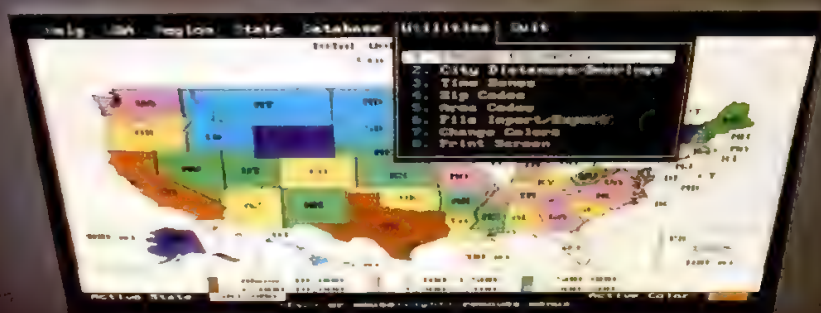


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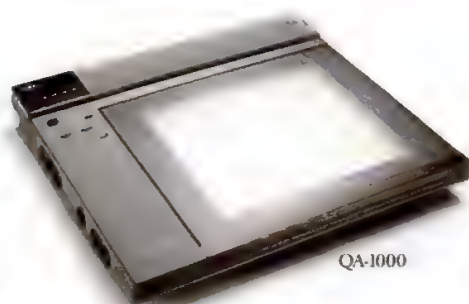
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Developing For Windows Is Easier Than Ever

The *Windows* scene is improving rapidly, thanks to a host of strong development tools that span a number of different skill levels.

The constant evolution of software is one of the most fascinating parts of the personal computer industry. As hardware becomes faster and more sophisticated, what we demand of software also increases. That could mean that writing software will only get harder, and software would increasingly become the domain of specialists. But I've been quite impressed lately by several application development tools that make programming easier.

Take the *Windows* environment. It wasn't that long ago that I constantly heard complaints about how difficult it was to program for *Microsoft Windows*. I still hear some complaints, notably about debugging and trying to avoid the dreaded "Unrecoverable Application Error" message. But on the whole, it's gotten much easier.

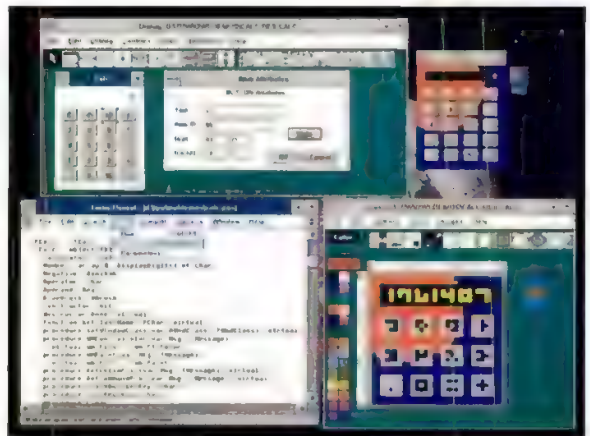
You now can choose from a whole spectrum of tools, ranging from those aimed at professional developers

to a number of tools aimed at people who just want to play around and create simple applications for their own use. Let's examine some of the many options available for *Windows* development.

For someone who wants to create a simple application but isn't really fluent in any of the traditional programming languages, *Windows* offers a variety of unique and interesting tools. *HyperCard*, by combining a simple scripting language with forms-based layout tools, proved that just about anyone could create interesting applications in the Macintosh world. Under *Windows*, there are several programs that follow the same model, including Asymetrix Corp.'s *ToolBook*, Spinnaker's *Plus*, and now *Oracle Card*, which is based on technology licensed from Spinnaker. None of these tools is particularly fast, but they do let you create simple, good-looking applications relatively quickly.

All of these programs use a simple, procedural scripting language. But if that sounds like too much work, you might take a look at Borland's *ObjectVision*. This development package combines a fairly sophisticated group of forms tools, but adds a twist. Instead of placing procedural code behind your various forms or buttons, as you would in *HyperCard* or *ToolBook*, you create decision trees with spreadsheet-style @ functions. This is terrific for if-then kinds of programming choices, such as giving a 5 percent discount on orders over \$500 and a 10 percent discount on orders over \$1,000. If you're the kind of person who thinks in decision trees or knows spreadsheets, the *ObjectVision* concept makes sense for creating simple applications that use a single data file. The program isn't a good choice for designing very complicated programs or working with multiple database files right now, although I expect that will change in future versions. Still, *ObjectVision* has a lot of good concepts that I expect to see incorporated into many other applications.

If you need to create a traditional database application, you can choose from several packages that make it relatively simple to store and



Borland's *Turbo Pascal for Windows* is one of many new tools that simplify the job of programming for *Windows*.

retrieve basic information. Two examples are the *Superbase* products from Precision Software, which is currently being acquired by Software Publishing Corp., and Blyth Software's *Omnis 5*. Alternatively, you could use one of the forms packages, although typically

Michael J. Miller

they don't have quite the range of database features. The database category remains one of the weak links among *Windows* applications. Still, that should change significantly over the next year, as the major database vendors finally finish their long-promised *Windows* versions.

Next, we come to tools that require some knowledge of traditional programming languages, but here too we have new tools that make the *Windows*-specific parts of programming much easier. For the many people who know BASIC, Microsoft's *Visual Basic* takes that old standard and brings it into the *Windows* era by letting you create windows, scroll bars, and menus just by selecting the appropriate tool from a palette, with no code necessary. You can

extend your program using various third-party dynamic link libraries that are coming out, so even someone with just a smattering of programming knowledge can create fairly sophisticated applications. I haven't yet seen Within Technologies' *Realizer*, but I hear it offers similar features.

If your tastes run more to Pascal, Borland offers similar features in its impressive *Turbo Pascal for Windows*. Again, it lets you do a lot of the *Windows*-specific things without programming, and by all accounts, it's a very fast environment. I'm also impressed with Borland's plans to create a variety of programming tools (including the Pascal, C++, and xBase languages, as well as future versions of *ObjectVision* and *Paradox*) that will access data in different formats ranging from *Paradox* to .DBF to various SQL databases. We'll have to wait and see how well this works when all the pieces finally come out. Similarly, there are a couple of okay SmallTalk and SmallTalk-like programming environments available.

PROFESSIONAL CHOICES, TOO

Finally, almost all of the commercial programmers I know do most of their *Windows* work in C. Not too long ago, your only choice in this arena was *Microsoft C* and its *Software Developers Kit*—a usable solution, but fairly complicated and not for everybody. C programmers now have many more options, ranging from other C compilers (notably *Borland C++*) to various toolkits that handle *Windows*-specific items (such as the *Whitewater Resource Toolkit*) to code generators (like Caseworks' *Case:W*).

All told, we now have a tremendous spectrum of application development tools. Whether you're a professional programmer or just someone who is creating something for your own use, you now have lots of choices. That's tremendously important, because it means that we should see not only more commercial applications in a more timely fashion, but also more of the personal applications and little utilities that have made it easier to run DOS.

Currently, most *Windows* users I know have to exit to DOS to run some applications and many small utilities. With all of these development tools leading to new applications, and with a more stable version of *Windows* due out around the end of the year, *Windows* may finally become an environment you never have to leave. ■

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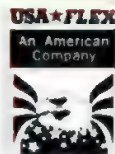
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CIRCLE 332 ON READER SERVICE CARD

Bill Machrone



Is There Life After 33 MHz?

While CPU performance continues on an upward spiral, it's time to look elsewhere for total system performance.

The horsepower race on the desktop is over, at least for the time being. Way back in 1987, we declared the 80286 brain-damaged and said that while we might continue to review 286-based machines, there would be no further Editors' Choices among them. The future belonged to the 386.

It still does. The 386 instruction set is the future. It's the heart of the 486 and the 586. But frankly, there's no compelling reason to go beyond the current level of CPU performance. The great majority of desktop applications, even *Windows*, are well served by the current crop of 386 and 486 processors. Executive editor Bill Howard posed the great rhetorical question: "Is any machine fast enough to run *Windows*?" The answer is a qualified yes. The CPU is fast enough, but the video subsystem is a huge performance bottleneck, especially in perceived performance.

The first VGAs and many boards that followed were not exactly rocket ships. Coprocessed boards lead the way in fast video performance, but at a price. A host of new high-performance Super VGA boards are just now coming to market. This new crop uses special-purpose chips designed to do just one thing: run VGA and higher resolutions at dazzling speeds. Unlike previous generations, these new video boards understand that *Windows* places major burdens on both the video subsystem and the CPU. They relieve the CPU of memory-intensive operations such as BitBlts (block transfers, not sandwiches).

My point is this: It would take a lot more CPU performance to get just a little more video performance. A faster CPU increases the cost of the entire system, while a faster video board localizes the price increase to a single component. The vast majority of users would never notice the increase in processing power, while virtually all of them would notice the increased video speed under *Windows*.

The same principles can be applied to the disk subsystem. You get most of the benefit just from software caching, but if you want the ultimate, then you go with an ESDI or SCSI hard disk controller. It is far more beneficial to the system's overall performance than any in-

cremental CPU speedup.

Into this brew we add Intel's new 50-MHz 486. Are you dying for a 50-MHz machine on your desktop? Me neither. Oh, sure, if you gave me one, I'd use it, and I'd be thrilled. But I don't need it the way I needed a 386. I'd rather have the performance where it would do some good. Interestingly, most of the new machines announced at Intel's introduction were multiprocessor systems running Unix, not desktop PCs. That's the real growth market for fast processors: file servers. Extra mips in the file server will run the ever-increasing number of server-based applications, utilities, and administrative tasks faster. Are you doing inter-server communications? Databases? Modem pooling? Remote administration? Fax gateways? You need more power to run these tasks without slowing disk access and printer response.

Then there's Intel's other new processor: the 20-MHz 486SX. Face it, the 486SX has no reason to exist. If it weren't for AMD's 40-MHz 386, Intel would never have bothered making the 486SX. Yes, it offers the greater internal speed of the 486, the simpler memory interface, and an 8K cache, but at the cost of the



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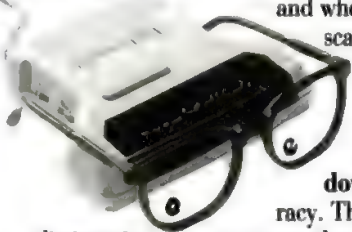
math coprocessor and dubious performance gains for existing applications. I won't argue the 486's superiority at full 32-bit operations, but the vast majority of today's software is still 16 bit and will be for some time to come.

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The upshot of AMD's successful cloning of the 386 is that the leading microprocessor builders in the country are engaged in a marketing war. That's good for your pocketbook,

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Bill Machrone

as Intel and AMD try to whomp the living daylights out of each other in the marketplace. The effect on the state of the art is still unknown. Sure, faster is better, but low power is better, too. You can burn your finger on a 486 chip—painful testimony to the amount of power it consumes. Intel has never been known for its prowess in building low-power chips, but it has been touting the 386SL as the answer to all our power-consumption problems. Sadly, the 386SL won't do beans for the big power hogs in your notebook computer: the display backlight and the disk drive. The SL itself saves a relatively small percentage of the system's overall power.

Yes, the SL has the ability to turn its peripheral devices on and off, and to vary its speed based on how hard you're using the system. As of this writing, designers are still wrestling with the SL's standby features, in order to make them reliable in protected mode. Worse, several manufacturers have elected not to implement the slowdown feature because the machines do badly on CPU benchmark tests. I have mixed feelings about this, since *PC Magazine* is one of the biggest promoters of CPU benchmark tests. Sure, we want the machines to be fast, but we also want them to save power.

Manufacturers have an education job ahead of them. They must show users that the next generation of notebook computers can be as fast as you need them to be, but that it's okay for these notebooks to slow down and conserve power when you're not pounding on them.

BURNING RUBBER

Intel senior vice president Dave House has called our benchmark tests "the *PC Magazine* drag races," where all-out performance reigns. That's not a bad comparison, but we've got some sharp turns and some hard stops in there, too. Taken together, they're an excellent overview of a system's performance, and they show tradeoffs, such as speed for battery life, quite clearly. Even so, we continue to refine our tests. Look for more user profiling in the future, where the way you use the machine goes a long way toward determining its performance.

Who knows? We might even find a use for 50-MHz machines. ■

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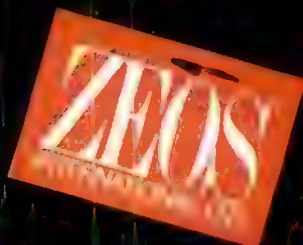
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John C. Dvorak



The Great Operating System Quiz

Finding the right operating system is as simple as ordering a pizza and answering some easy questions.

In the months (and perhaps years) ahead, many of us will be confronted by a decision: What operating system to choose? DOS? OS/2? Unix? DOS with *Windows*?

As I watch more and more users choose sides, it's apparent that there are aspects of individual personalities that work into the decision. So I did some arduous research to develop one of my famous tests to help people determine which operating system is best for them. I examine a combination of both computing needs and personal habits. Circle either the DOS, OS/2, W (for *Windows*), or Unix choice next to your favorite answer. Count up

the number of answers for each choice. Whichever one dominates should be the right operating system for you. If there is a mishmash of answers, then you should probably wait a year.

Dvorak's Operating System Quiz

1. What application do you expect to use the most? DOS) spreadsheet; OS/2) large complex database; W) solitaire; Unix) GREP.

2. What is your favorite TV show? DOS) "Nova"; OS/2) "The MacNeil-Lehrer Report"; W) Woody Woodpecker; Unix) the 3:00 A.M. test pattern.

3. What is your favorite hobby? DOS) stamp collecting; OS/2) bird watching; W) snail racing; Unix) button collecting.

4. What kind of clothes do you prefer? DOS) sports suit, no tie; OS/2) suit and tie; W) sweater and jeans; Unix) Nerdy T-shirt, jeans, and no underpants.

5. What kind of music do you like? DOS) The Beatles; OS/2) classical; W) New Age fusion music; Unix) tuba solos.

6. What's your favorite color? DOS) modern beige; OS/2) blue; W) stark white; Unix) pizza-stain red.

7. What's your favorite car? DOS) Ford; OS/2) Lexus; W) fake Bugatti; Unix) Borgward.

8. Who is your favorite artist? DOS) Rembrandt; OS/2) Pollack; W) Dali; Unix) Gary Larsen.

9. Who is your favorite author? DOS) Robert Heinlein; OS/2) Tom Wolfe; W) John Madden; Unix) Walt Disney.

10. Who is your favorite actor? DOS) Rod Steiger; OS/2) John Wayne; W) Leonard Nimoy; Unix) Richard Simmons.

11. Who was your favorite president? DOS) Abe Lincoln; OS/2) Ronald Reagan; W) Jack Kennedy; Unix) Hubert Humphrey.

12. What's your preferred breakfast food? DOS) cereal; OS/2) steak and eggs; W) soft-boiled egg; Unix) pizza.

13. If time wasn't important, how would you prefer to travel? DOS) walk; OS/2) steam train; W) hot air balloon; Unix) pogo stick.

14. (to be answered by men) If you were stuck on a desert island with only one woman, whom would you choose? DOS) Kim Basinger; OS/2) Meryl Streep; W) Dr. Ruth Westheimer; Unix) a photo of Kim Basinger.

15. (to be answered by women) If you were stuck on a desert island with only one man, whom would you choose? DOS) Kevin Costner; OS/2) Arnold Schwarzenegger; W) Bill Gates; Unix) a photo of Kim Basinger.

16. When you get up in the morning, what is the first thing you do? DOS) shower; OS/2)



ILLUSTRATION: KEN CONDON

brush teeth; W) gargle; Unix) pick off food stuck to body from sleeping with pizza.

17. What's the last thing you do before going to bed? DOS) let out cat, turn off lights; OS/2) brush teeth; W) pray; Unix) check to see if there is a pizza in the bed.

Tally your score and don't waste a minute finding pleasure in the operating system that suits you best. One disclaimer I have to make: Anyone scoring 17 straight "Unix" answers should seek counseling immediately.

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Inside Track

Expect to see British inventor **Clive Sinclair** pull the rabbit out of the hat with a **hot notebook** using a proprietary Sinclair-designed **200-mips RISC chip** that can emulate the Intel family. The chip, fabricated by Plessy, will mark a new career for Sinclair if successful. Even Apple is supposed to be looking at this chip.

Details on the Sinclair chip are sketchy, but it seems to be a parallel **high-speed chip**. Sinclair is a believer in small data words in personal computers so it's probably 8-bit (maybe 4-bit). The parallelism designed into the chip supposedly allows it to fake 16- or 32-bit operations. This chip is also meant to be dropped into a low-priced super notebook computer also designed by Sinclair. The machine will run **DR DOS 6.0** and a Unix/Mach-type operating system called **TAOS**.

IBM Has Gone Berserk Dept.: Confusing and manic are the words to describe the rate at which IBM is **grabbing** strategic partners. Everyone assumes that it's just to gain as much support as possible for Version 2 of OS/2. IBM wooed **Borland** one minute and **Lotus** the next. And all this is going on while Lotus is suing Borland over copyright infringement.

Smokescreen Dept.: The talks with Lotus may be more than just seducing an OS/2 partner. The rumor in Silicon Valley was that OS/2 was a **cover-up excuse** for the real meetings where Lotus talked about **developing an operating system for IBM**—something to replace MS-DOS on the low-end machines.

This was encouraged by a **leaked Microsoft memo** from Bill Gates where he criticized IBM's **shoddy code**. Miffed by this and other Microsoft insults, IBM now may want to **dump Microsoft** and perhaps even move to Digital Research, a company that has actually moved ahead of Microsoft in operating system development on the MS-DOS-compatible level. Furthermore, DRI is now run by Dick Williams, an ex-IBMer who has **strong ties** to the old entry-systems people. The **deal of the decade** would be for Lotus to contract with IBM for operating system work under the proviso that Lotus buy or merge with Digital Research.

Compaq, Microsoft, and the Strange Bedfellows Dept.: Of course the roots of the final dissolution between Microsoft and IBM was not the memo, but the **ACE consortium**. Something that doesn't go away are the **dreams of a better future** and idealistic standards created not by a powerhouse such as IBM, but by a committee of happy-go-lucky competitors. It's a **fools paradise**. Even the Japanese rely on MITI (the

Japanese Ministry of International Trade and Industry) or JEIA (Japan Electronic Industry Association) rather than a consortium. (We used to rely on IBM—which now seems to be unsure of itself.)

The typical committee-directed dream ship of a better future for desktop computers always seems to have Microsoft aboard. The **derailed MSX standard** that never happened was a good example of Japanese companies (with Microsoft) agreeing on something nobody wanted. Then came the PC-AT/AX machine utilizing the J-EGA display. **Another fiasco**. IBM is trying an "AX"-like maneuver with a slew of Japanese manufacturers. These are attempts to unseat NEC from its dominant position in the Japanese domestic market.

If Microsoft isn't involved in these things, then **Compaq** seems to be the torch bearer. Compaq has had a bit more success, but hardly on the scale of IBM in the old days. The IDE disk drive is largely a Compaq invention. Most modern drives now use this drive standard. Unfortunately, Compaq had almost kept the IDE drive a **secret** from the public. Perhaps a public relations campaign may have worked better than whatever it is they did (or didn't do). Then came EISA (the Extended Industry Standard Architecture), largely a Compaq creation in conjunction with a **slew of wannabees**. EISA has not been nearly as successful as the computer industry had hoped. Now comes ACE (Advanced Computing Environment). Again Compaq is the brains behind this attempt

to change the direction of the personal computer standard by **creating a futuristic "workstation"** that is expected to develop into the desktop standard of the second half of the 1990s.

Suddenly another bus load of wannabees jump on the ACE chain gang. But to understand ACE, simply check the mailing list for the founders: Silicon Graphics, m.i.p.s., DEC, Compaq, and Microsoft. It's a list that invites a "what's wrong with this picture" comment. **One lone software company**. I believe that Microsoft's membership on this **engineering junta** is what really ripped open the **festering rift** between Microsoft and IBM. The much-publicized "leaked" Gates memo was probably meaningless and perhaps designed to distract attention from the real concerns of IBM regarding Microsoft.

Dvorak's Rule of Thumb: Hard economic times are upon us when innovation is cast aside in favor of litigation and dubious partnerships.

The deal of the decade would be for Lotus to contract with IBM for operating system work under the proviso that Lotus buy or merge with Digital Research.

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Jim Seymour



Paid Support: A User's Bill Of Rights

If everyone plays by the same rules, paid technical support will benefit the whole PC community.

A year ago, in our first service and support special issue (Service and Reliability, September 25, 1990), I wrote about my sense that the rules of the game were changing in PC support. Vendors would, I said, increasingly move to various forms of paid support.

I don't like paying for something I'm used to getting for free any more than you do. But, I said, I thought this change was for the better: It's our best hope to clean up the increasingly terrible support situation. I also thought it would promote equity, by distributing the costs of after-sale support among only those who actually seek support, not across all users of a product.

A number of readers wrote to tell me where I could put that forecast. They liked, expected, and would demand free support, they said. They hated annual support contracts, 900 numbers, credit-card help calls and the rest of it. If WordPerfect could offer free, unlimited, 800-line support so success-

fully, why couldn't everyone else?

A CALL FOR BETTER SUPPORT

In the year since then, I've talked with a lot of users about moving to paid support. I looked into what they thought of the idea and the various forms this support might take. And I learned that the angry letter writers represented a real constituency—but that it was a small one, a fraction of *PC Magazine* readers. Most users agreed that better support was worth paying for.

In those talks, and in meetings with vendors considering paid support, I've been searching for some common ground, a basis on which users and vendors might be able to agree on equitable rules for support.

From the many hundreds of conversations I've had I've developed a *User's Bill of Rights* on PC support. What follows is not the whole answer...but if we begin with this, we have a good chance at winding up with a fairer system that delivers better support.

1. Paid support is only acceptable if it

coexists with free support. PC hardware and software buyers deserve a grace period during which they can get free help. I think 90 days is sufficient: That takes the new user through the learning curve, as well as through the time most hardware problems emerge. Thereafter, at least some forms of free support—such as “off-line support” via fax-back systems and vendor forums on electronic networks—must continue.

2. Paid support must be truly excellent. Vendors can't get away with charging for lousy support. That doesn't mean free support can become any more of a backwater than it is today. But paid support in *any* form will always be perceived by customers as premium support—and it had better live up to that expectation.

3. Paid support is more appropriate for some kinds of products than others. Networking hardware, for example, demands high-level support—for which users should be willing to pay. Vertical-market software packages also demand high-level support—for which users should be willing to pay. But vendors shouldn't confuse these cases, where charging for support is equitable, with a notion that



ILLUSTRATION: KEN CONDON

every product justifies paid support. It's simply not true.

4. Paid support must come in a variety of forms. Some people have trouble with 900 numbers and would rather use credit cards. Many offices prevent employees from dialing 900 numbers by placing a lock on the phone system. Some people hate credit cards (especially in an office: It's a pain to have to wait 'til you get the credit-card statement, then turn

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CIRCLE 250 ON READER SERVICE CARD

Jim Seymour

in a support-call charge on an expense account), and prefer 900 lines. Some want per-incident billing; some prefer package deals, such as ten calls for \$250; some people prefer flat annual fees for unlimited calls. Vendors need both a variety of support options and a variety of ways of paying for that support.

5. Flat fees per episode are far more palatable than by-the-minute billing. Both users and support personnel behave very differently when the meter is ticking. Callers are inclined toward suspicion—is he dragging this thing out like this to jack up the charge?—while support people are inclined toward quicker, less thorough, and less satisfactory inquiries into users' problems. Get rid of the taxi meters.

6. Tech-support personnel must have wide discretion *not* to charge for a given call. Clearly there are some kinds of calls where no charge should ever be made: When a user calls with a problem arising from a previously unknown bug, when a user calls with a problem arising from a *known* bug, or when the support person can't provide an answer. I'd add to that list calls where the person seeking help is angry, thinks the company is at fault, and feels unjustly treated.

7. Vendors have to deliver *solutions*, not just answers. It's not acceptable to charge someone five bucks, then tell him or her to go read the answer to the problem on page 349 of the manual.

8. Vendors have to deal with a broad range of queries. Many calls to a vendor's support lines deal with problems not related to that vendor's products. We call hardware vendors to ask about DOS, Microsoft Windows, and Lotus 1-2-3. We call software vendors to ask about printers, modems, memory expansion, and disk crashes. If a vendor is going to charge customers for a call, he or she must deal with the problem at hand—whether it's the product's fault or not.

Smart vendors are putting these basic principles into place today. Sure, some dumb vendors will screw up, charging for lousy support and antagonizing their customers.

But more will see this—are seeing it—as a real business opportunity: A chance to develop a revenue stream that also earns them a reputation for great support.

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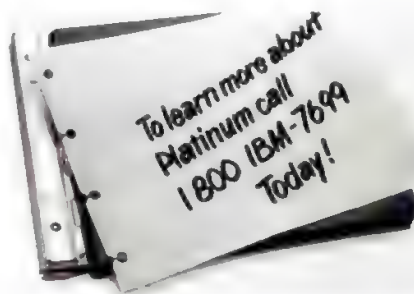
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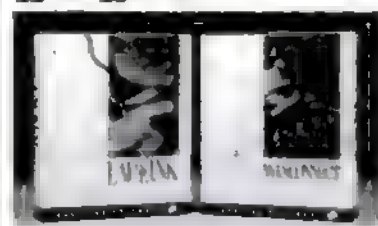
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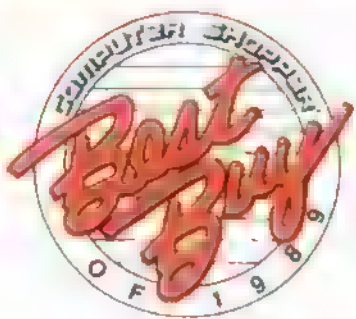
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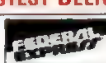
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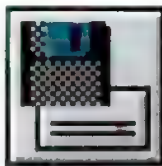
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William F. Zachmann



EISA On Down the Road

IBM's commitment to Micro Channel architecture need not prevent the introduction of an IBM EISA machine.

EISA systems from IBM? Absurd! After aggressively promoting Micro Channel architecture for over four years, why should IBM introduce EISA systems? Because it makes sound business sense for IBM to do so. I would not be the least bit surprised to see EISA systems from IBM in the next year or two.

Of course, it is easy to argue to the contrary. If MCA really is better than EISA, as IBM has consistently claimed, it makes little sense for IBM to embrace the latter. Second, millions of MCA systems have been sold over the past four and a half years, and many users seem to prefer MCA to EISA.

Third, although MCA did not become the definitive industry standard, it is supported by numerous board vendors and system vendors. Fourth, IBM has made enormous efforts to develop and promote MCA as the definitive bus standard for the future. Finally, the introduction of an EISA system might harm IBM's credibility with customers.

These reasons just do not add up to a compelling argument for IBM to avoid EISA. To begin with, it has been amply demonstrated that—despite IBM's claims that MCA is superior—Micro Channel systems do not have substantial performance or functional advantages over EISA- and ISA-based systems. One need only look back over *PC Magazine* product comparisons to see that many 16-bit ISA systems outperform comparably configured 16-bit IBM PS/2 models. At the 32-bit level, EISA machines often equal or better their PS/2 counterparts.

Further evidence is found in this very issue, in a comparative review of 486 machines with EISA, ISA, and MCA buses. While IBM may be right about the theoretical advantages of the MCA bus, MCA shows no clear superiority over EISA in practical use.

MCA's "success" is no reason for IBM to shun EISA, either. Though IBM has sold millions of MCA systems, they have been bought mainly because they were IBM systems and not because they were MCA systems. IBM's efforts to develop and promote MCA are also not a reason for the company to insist on selling only MCA systems. Despite IBM's

efforts, MCA has not become the definitive standard for the industry.

As for IBM's "credibility," that too is no reason for IBM to avoid EISA. Were IBM to abandon OS/2 (or even *OfficeVision*), its credibility would certainly suffer because many of IBM's customers have a substantial stake in IBM's past promises. But if IBM were to introduce EISA systems in addition to MCA systems, customers who preferred to buy IBM MCA systems could still do so.

Even if there are no compelling reasons why IBM should not introduce EISA systems, are there compelling reasons why IBM *should* do so? Yes.

The first is simply that if IBM were to offer EISA systems, plenty of customers would buy them! By introducing new PS/2 models with the ISA bus architecture, IBM has acknowledged continued customer demand for ISA systems. While some customers have been willing to buy MCA systems from IBM, plenty of others prefer to buy ISA and EISA systems. The second reason is that IBM EISA systems would signal IBM's firm intention to abandon the misguided effort to re-create a proprietary advantage with MCA.



Third and equally important, IBM EISA systems running IBM OS/2 2.0 with Presentation Manager would make it clear to all that OS/2 2.0 is *not* proprietary to IBM. An IBM version of OS/2 2.0 running on IBM EISA systems could then be sold for use on other vendors' EISA systems, much as IBM's DOS typically runs on other vendors' ISA systems. There is no reason for IBM to make a religion of MCA. EISA systems can be just as profitable for IBM as MCA systems. ■

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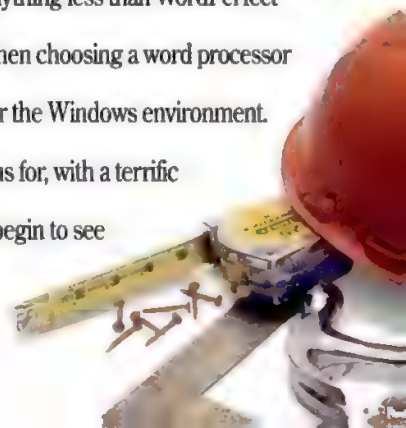
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anything less than WordPerfect when choosing a word processor for the Windows environment.

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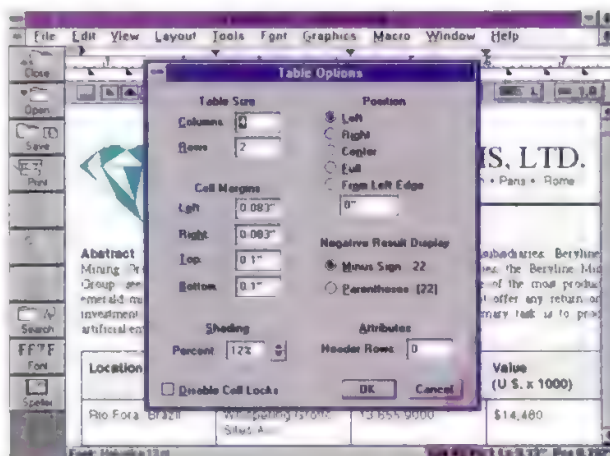
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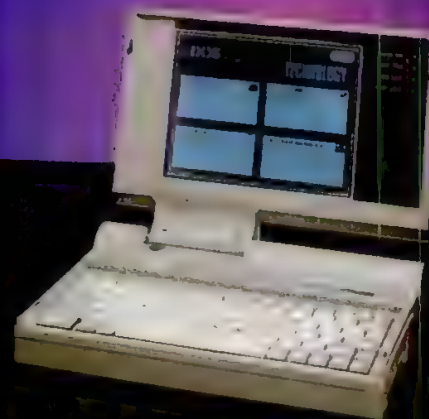
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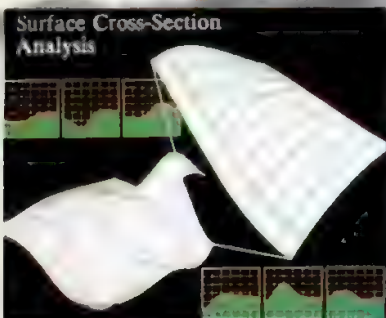
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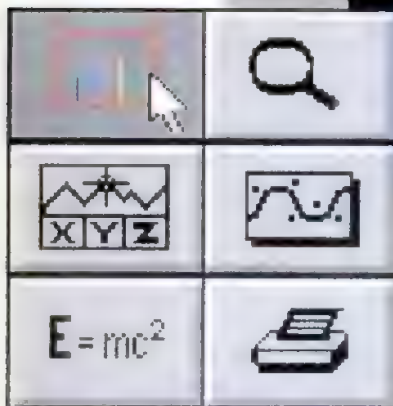
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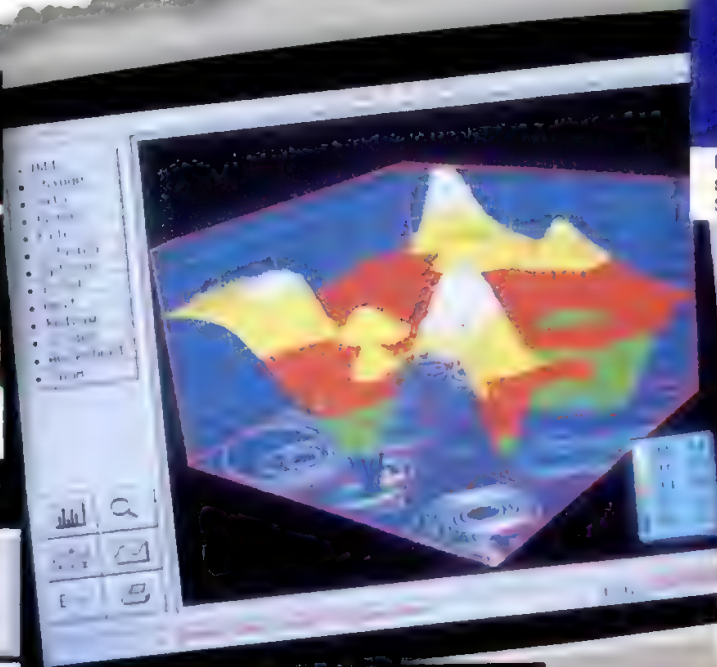
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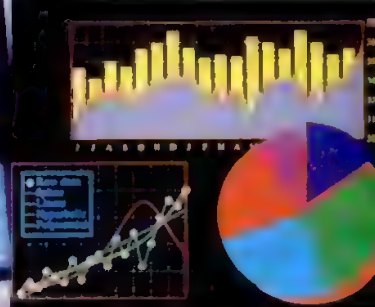
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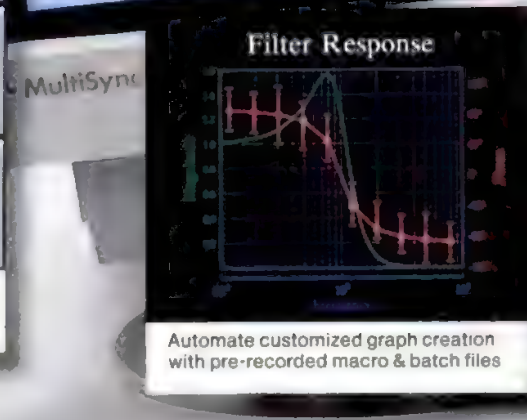
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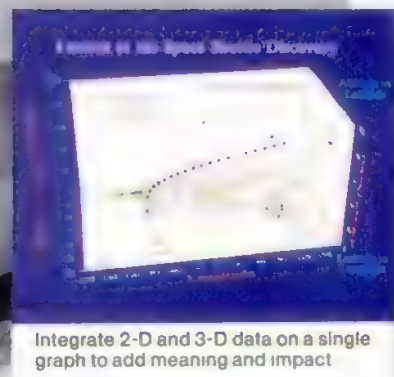
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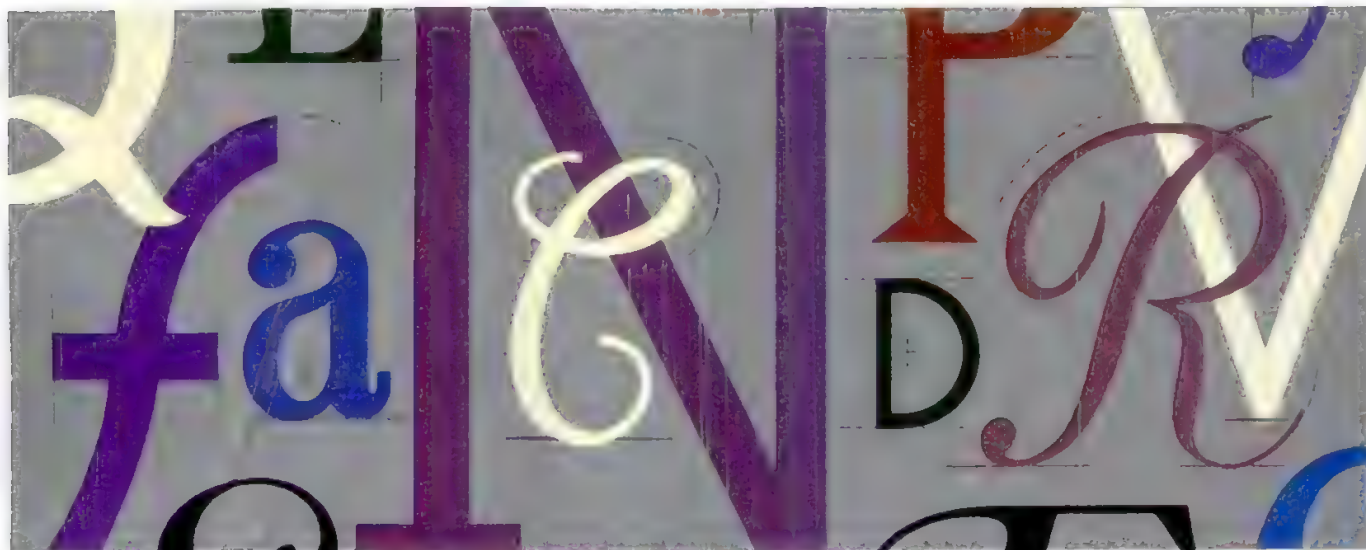
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BEYOND TIMES AND HELVETICA



Scalable Fonts for the PC

by Edward Mendelson

There's more to type than the fonts built into your laser printer. To add a special touch to your documents and presentations, check out the scalable fonts sold in standard formats by these nine vendors.

Type is the medium and vehicle of the printed word. When used effectively, it enhances communication by clarifying the structure and emphasis of your text, or by letting you forget its existence as you read hundreds of pages of unobtrusive printing without fatigue. When used badly, it can hinder communication by conveying a visual mood on the page that works against the verbal mood of the text, or by forcing you to notice the typographer's originality or ingenuity when you are trying to pay attention to the content of the words.

When Hewlett-Packard's LaserJet and other low-cost laser printers arrived on desktops, the era of typewriter-style printing ended for the PC. The average user could finally replace the fixed-width or monospaced fonts in most dot matrix and daisy wheel printers with proportional typefaces

that reflect the hard-won experience of five centuries of hot-metal typography. The first programs to exploit these typefaces were high-end desktop publishing packages, but popular word processors such as *Microsoft Word* and *WordPerfect* soon made them an integral part of the ordinary office environment. Today monospaced type is suitable only for internal documents or special-purpose documents (such as spreadsheets or manuscripts sent to a publisher). The improved clarity and legibility of proportional type make it increasingly difficult to justify using your computer as a glorified typewriter.

Times Roman and Helvetica (or their equivalents), the two typefaces built into most of today's laser printers, are versatile and readable designs that deserve their popularity. Overuse makes them look stale, however, and you can easily find font cartridges and disk-based soft fonts that provide typefaces better suited to almost any kind of document. Until recently, add-on typefaces required elaborate font-management utilities that discouraged all but the most expert and determined users. But improved software and firm industry standards now make add-on typefaces almost effortless to work with, and the profusion of designs now on the market lets you create pages more striking and convincing than anything possible without a full-fledged printing press ten years ago. If you limit your documents to Times or Helvetica, you are depriving them of the clarity and excitement they deserve.

ONE SIZE FITS ALL

The following reviews survey the offerings of the PC market's nine major vendors of scalable type, the second-generation font technology that lets you generate different sizes of the same design from a single typeface outline file. Compared with the bitmapped fonts used by the first generation of laser printers, scalable typefaces are far more versatile and efficient.

For a single typeface (Garamond, for instance), if you want to set 24-point headlines, 12-point text, and 8-point footnotes, you need only a single Garamond outline instead of three separate bitmap files. Your printer (or software such as *Adobe Type Manager* for *Microsoft Windows 3.0*) does the job of rendering all the sizes you choose (see the sidebar "How It Works: The Ins and Outs of Scalable-Font Technology"). Because of the processing

Until recently, scaling type on the fly was a luxury for most PC users.

needed to generate characters on the fly, you may have to wait a few seconds to a few minutes longer to see a page printed with scalable type than one printed with bitmapped fonts. But you won't have to clog your hard disk with reams of font files for all the different sizes you might want to choose.

Until recently, scaling type on the fly was a luxury for most PC users. The only widely supported technology was the Type 1 font format used in Adobe's PostScript page description language. Serious desktop publishing people flocked to PostScript for its device independence and its superb graphics support, but for ordinary business use, desktop PostScript printers were forbiddingly slow—and forbiddingly expensive because of Adobe's licensing fees.

That changed last year after Apple and Microsoft announced their intention to develop a scalable-font technology that will compete with Adobe's virtual monopoly. First, in an abrupt about-face, Adobe published the once-secret Type 1 font specification, including the hinting techniques that let Type 1 fonts maintain clarity at small point sizes on low-resolution printers. Then it released *Adobe Type Manager* for *Microsoft Windows 3.0*, which let you use all Type 1 fonts not only with PostScript printers but also with HP LaserJets and any other printer supported by *Windows*.

These two actions transformed Adobe's closed, proprietary technology into a virtually universal standard for digital type. Today, Adobe and its licensees Agfa Compugraphic, Linotype-Hell, and Monotype Typography offer huge libraries of Type 1 fonts for the PC; so too do independent vendors such as Bitstream, Casady & Greene, Digital Typeface Corp., and Image Club Graphics. *Adobe Type Manager* is bundled with a host of applications from Aldus, Lotus, and others, and with

OS/2, Version 1.3. Type 1 is now so unshakable a standard that even its rival, TrueType, will let Type 1 fonts coexist smoothly with fonts in its own native format.

COMPETING STANDARDS

Despite its dominance, Type 1 shares the scalable-font market with rival technologies, some of which have broad enough support to challenge Type 1's preeminence. Intellifont, developed jointly by Agfa Compugraphic and HP as the hinted font format for HP's PCL 5 printer language, is a powerful competitor simply because it is built into the most popular desktop printer today, Hewlett-Packard's LaserJet III.

Intellifont has made few inroads into the PC graphics market, but business users have discovered that it costs less and prints more quickly than equivalent PostScript implementations—although the performance gap may be narrowed by PostScript Level 2 and improved PostScript drivers. Fewer than 200 hinted Intellifont faces are now on the market, but Agfa Compugraphic has now followed Adobe's example by publishing the specification, and third-party releases should follow soon. In the meantime, you can get unhinted Intellifont outlines from Digi-Fonts, or from Bitstream, either directly or via conversion from its Fontware format. You can also get them in cartridge form from IQ Engineering.

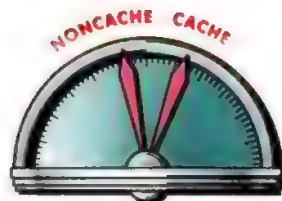
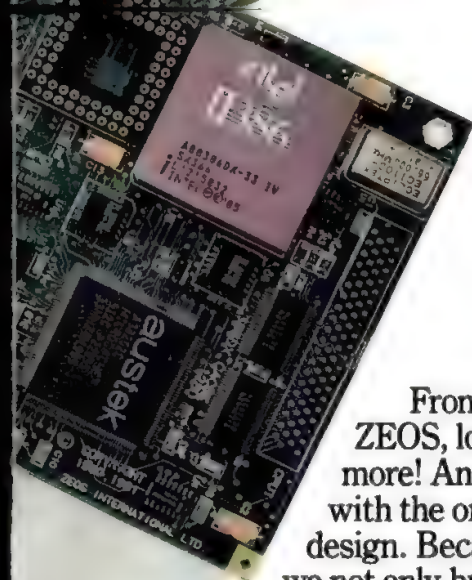
Bitstream, whose earlier Fontware technology once dominated the PC market for bitmapped fonts, hopes to make its new Speedo technology yet another standard for scalable fonts. Unlike Intellifont and Type 1, Speedo is not available in printers; instead, it is designed to be built into software so that your PC can generate the fonts. Speedo is compact enough to work in memory-constrained DOS applications, and it has garnered a considerable amount of support: It is the native font format for the DOS versions of *Freelance* and *Lotus 1-2-3*. IBM's *Hollywood* presentation graphics program and *Signature* word processor, Software Publishing Corp.'s upcoming version of *Harvard Graphics*, and many others announced and unannounced. *Windows* applications are also supported through *FaceLift for Windows*, the Speedo counterpart to *Adobe Type Manager*.

Unlike Type 1 and Intellifont, Speedo remains a proprietary technology (Bitstream is considering making it an

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Working closely with major component manufacturers, ZEOS engineers design for the very best performance, reliability, and ease of support. As an example, your new ZEOS system board utilizes the very latest in high integration surface mount technology. This VLSI (Very Large Scale Integration) technology increases reliability, lowers costs and allows us to utilize the most advanced manufacturing techniques. The result is a *very reliable, very expandable* system *made in America* that delivers a value to you that nobody else can touch. And are these babies fast!

We're talking *incredible* speed. We start out with the processor of your choice. To it we add our amazing *53 nanosecond DRAM*, it's the fastest money can buy. In shopping for a computer, be sure to ask the others the speed of the DRAM they propose to include in your system—if the number is larger than 53ns (ex: 80ns) then it's correspondingly *slower* than what you'll be receiving from ZEOS.

appreciate (especially if you've had experience with some of the others). Sure, Teac® drives cost us a little more but you're buying your new ZEOS system because you don't want to compromise. And then there's the I/O.

If you've ever worked with serial, parallel and game ports, you know they can be deceptively tricky. So we've taken our famous ZEOS I/O system and placed it right on the motherboard. You can even set your ports (if you wish) using software built right into the BIOS. It's the easiest ever! And of course, it saves you yet another expansion slot for you to use now or in the future. Just how expandable is your new ZEOS system?

Very expandable. While others are trying to get you to accept fewer slots, we give you *eight*. And of those eight expansion slots, seven are open for your future use while one is used for video (video standards change too rapidly to lock you into one video standard). After all, expansion and non-obsolescence are important benefits of these great new ZEOS systems. That's why we're giving you some other very important expansion features too.

ZEOS COMPLETE SYSTEM PACKAGE #1

- The Processor and Speed of your choice plus future upgradability!
- 1MB of High Speed 53ns DRAM, expandable to a system total of 32MB right on the motherboard.
- 42MB High Speed IDE hard drive with its own cache.
- 1.2MB or 1.44MB Teac® floppy drive.
- ZEOS 14" flat screen Hi-Res amber monitor with Tilt/Swivel base.
- Shadow RAM and EMS support for enhanced performance.
- ZEOS/RS 101 key SpaceSaver keyboard.
- Two Serial, one Parallel & one Game Port built right onto the motherboard.
- 7-16, 1-8 bit expansion slots. 80387 math co-processor support for '386 systems.
- Rugged ZEOS SpaceSaver case with twin cooling fans for added reliability and product life.
- Seven drive bays and our custom 300 Watt power supply for your future expansion!
- Includes ZEOS 24 Hour a Day Toll Free Technical Support and Customer Satisfaction package.

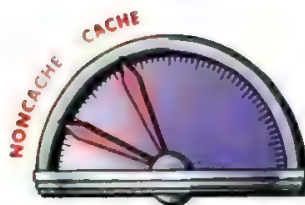
PACKAGE #1

INCREDIBLE ZEOS PACKAGE #2

We take Package #1 and upgrade your ZEOS Modular System to include:

- 2 full Megabytes of Rip-roaring 53ns DRAM.
- Our incredible 85MB IDE hard drive with its own built in cache.
- Both the Teac® 1.2MB and 1.44MB floppy drives.
- The awesome Diamond SpeedStar Plus VGA graphics card Complete with 1MB DRAM.
- ZEOS 14" High Res VGA Mono Monitor with Tilt & Swivel base.
- Microsoft® DOS plus Microsoft Windows plus a Microsoft Mouse.

PACKAGE #2



Z•SPEED METER: ZEOS 386-25

The ZEOS 386-25 is perhaps the perfect desktop system. For even more power, add a blazing 128K Cache for only \$200!

With ZEOS, choosing your next computer system is easy! Because now, ZEOS gives you upgradable

CPUs, power that will *blow the doors off* anything else out there *and* prices that are absolutely incredible. First, simply pick the power that you want today.

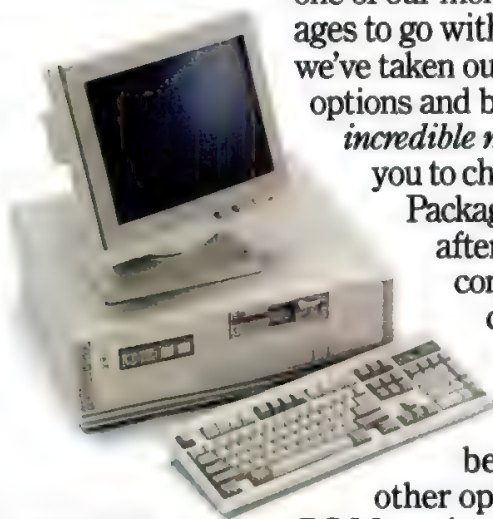
Picking your power is easy. Just tell us which of the upgradable CPUs you would like

386-25! \$1,3

486-33	\$1795
486SX-20	\$1595
386-33	\$1495
386-25	\$1395

to have in your new system. Select either the 386-25 or 33MHz or move right into the '486 world with the new 486SX-20 or the amazing 486-33. Now that you've picked your CPU power, it's easy to pick one of our money saving option packages to go with it! Because at ZEOS, we've taken our most popular upgrade options and bundled them into *four incredible money saving packages* for you to choose from. Starting with Package #1, we've added option after option giving you a complete range of system configurations. And if one of these four packages isn't exactly what you want, let us know

because we have lots of other options too. After all, as *PC Magazine* said, ZEOS offers "more options than even the most configuration hungry hound could possibly need." Upgradability. Power. Performance and Price. What more could there be?



486-33	\$2395
486SX-20	\$2195
386-33	\$2095
386-25	\$1995



Upgradable. Low Cost.

Hot New ZEOS '386 and '486 systems!

Upgradable. High Performance. Low Cost. Unbelievable? Believe it! Because now ZEOS® gives it all to you in one complete package.

Starting complete with the ZEOS 386-25 at only \$1395 right thru '486-33 MHz systems starting at \$1795, computing will never be the same again! And it's not just the prices that make these new systems hot. It's Performance and Upgradability as well.

When we first sat down to design these new systems, we wanted computers that would *blow the doors off* anything else out there. Plus, we wanted you to be able to upgrade from one CPU to another as your computing requirements changed, *without having to buy an entirely new system*. The results?

Incredibly low cost, high performance systems so very advanced you can freely upgrade from the '386 family of processors to the latest '486s all without a

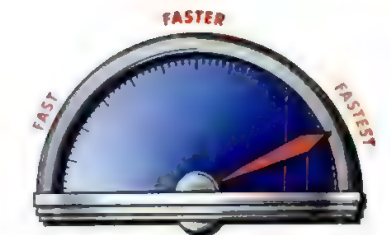
moment's hesitation. But are the prices really that good?

Yes. *Absolutely Yes!* The prices really are that good, and the quality too. Because when you buy from ZEOS you're

buying directly from the manufacturer. Starting with the main system board, your new computer is designed and built by us right here in Minnesota. That saves money for you. And your ZEOS factory direct advantages are evident not only in the price, but in the performance and quality of your system too.

So if you're looking for

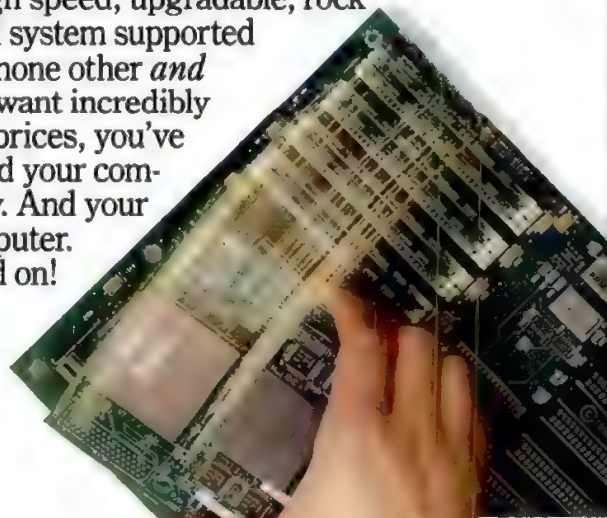
a high speed, upgradable, rock solid system supported like none other *and* you want incredibly low prices, you've found your company. And your computer. Read on!



Z • SPEED METER

To help you select the processor option that's right for you, we have developed the Z-Meter.

The Z-Meter shows you the relative performance gains achieved by moving from one processor module to another—fast, faster, fastest!



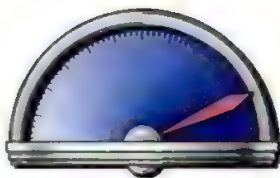
customers should be more than a part time proposition. That's why we invented *24 Hour a Day Toll Free Technical Support*. We did it for you, and is it ever good! Should you ever need assistance, a factory trained ZEOS technician is only a phone call away, any time of the day or night. With ZEOS you can have complete confidence in support, in your system and in the company.

You can buy with confidence too because ZEOS is a strong and rapidly growing public company (NASDAQ NMS Symbol: ZEOS). Our professional Systems Consultants and expert Technical Support staff serve tens of thousands of customers World Wide, Twenty-Four Hours a Day. Price. Performance, Quality, Expandability and Support.

There are *many* reasons to buy your new ZEOS system. All of them backed by your ZEOS Customer Satisfaction Package which includes our 30 Day Money Back Guarantee, One Full Year Limited Warranty and our Express Parts Replacement Policy. For even more ZEOS advantages be sure to see the section entitled "*Why ZEOS is Your #1 Choice!*"

Ordering your new ZEOS system is indeed easy. Simply pick the Power and the Package you want or let us custom build your new system to your exact specifications. Whatever you decide, a friendly and knowledgeable ZEOS Systems Consultant is waiting to assist you right now. And whatever you select, one thing is for certain.

Buying your new ZEOS system is perhaps the very best purchase decision you'll ever make! So why not give us a call right now. You're going to be very satisfied. We don't just say it. We guarantee it! *Call Now Toll Free, 800-423-5891.*



Z* SPEED METER: ZEOS 486-33

*Top of the charts!
Chances are you've never seen speed like this before. Throw in the afterburners with our 128K secondary TurboCache at only \$200 additional.*

486-33 \$2895

486SX-20 \$2695

386-33 \$2595

386-25 \$2495

INCREDIBLE ZEOS PACKAGE #3

Add even more memory, a larger drive. And more Savings! You now receive:

- 4 full Megabytes of Ultra High Speed 53ns DRAM.
- Our fast 130MB IDE hard drive with built in cache.
- Both Teac® floppies, the 1.2MB and 1.44!
- Your Diamond VGA Plus card with 1MB DRAM.
- ZEOS 14" High Res 1024 x 768 VGA Color Monitor with Tilt & Swivel Base.
- Plus, Microsoft® DOS, Windows and Mouse!

PACKAGE #3

THE ULTIMATE ZEOS PACKAGE #4

Now, Memory goes to 8MB and the drive to 210MB. The ultimate Power User's Dream Machine!

- 8 full Megabytes of High Speed 53ns DRAM.
- Your screaming 210MB IDE hard drive with its own built-in cache.
- Both Teac® floppies, the 1.2MB and 1.44!
- The Diamond VGA Plus color card with 1MB DRAM.
- ZEOS 14" High Res 1024 x 768 VGA Color Monitor with Tilt & Swivel Base.
- Plus, Microsoft® DOS, Windows and Mouse!

PACKAGE #4

**ORDER NOW TOLL FREE
800-423-5891**

FAX Orders: 612-633-1325

Hearing Impaired (TDD):

800-228-5389

Govt. & Educ.: 800-245-2449

Outside US and Canada

Call: 612-633-6131

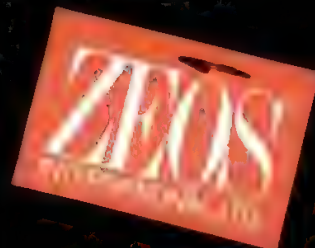
MasterCard, VISA, Discover,

Am Exp, Z-CARD, COD and

Leasing Programs.

Open 24 Hours a Day,

365 Days a Year!



Folded edge of the page

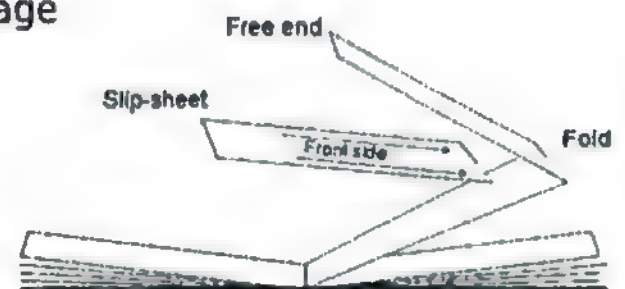
Inverted Foldout slip-sheet



GbsSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

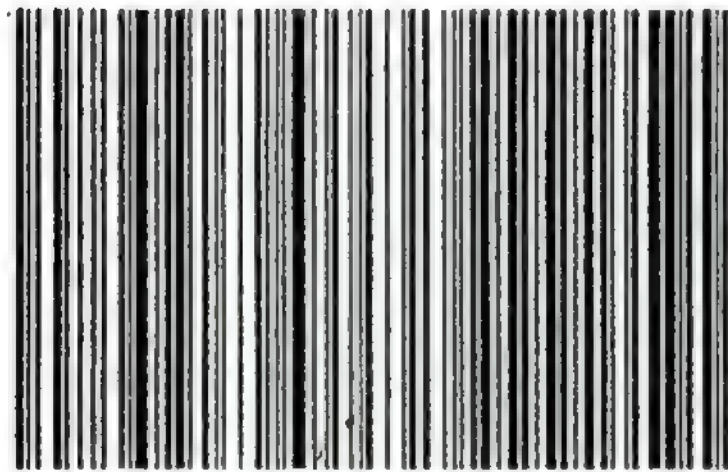


1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



GbsSlipBack-0018

Back

1. Follow instructions on the other side

Like our 300 watt power supply. Providing you with all the pure clean power you'll need right now, your ZEOS 300 watt supply also provides you with plenty of power for later as well. Plenty of slots, plenty of power. How about

room to expand? This is where ZEOS has performed something akin to magic.

It's your new ZEOS

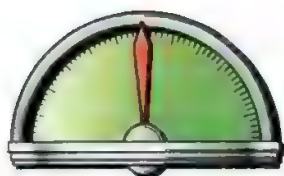
SpaceSaver case! Complete with *seven drive bays, this incredible case is actually smaller than* many cases

offering only five drive bays. And

this baby is built. We've gone so far as to specify the steel to be 0.20mm thicker than the steel used by most of our competitors. Right down to the top quality nickel plating on the inside, there's nothing else like it. And we didn't stop there.



For Vertical Systems add only \$150.



Z-SPEED METER: ZEOS 486SX-20

If you're interested in owning '486 processing power this is a great place to start! Turbo Charge your 486SX even more with our 128K TurboCache upgrade for only \$200 more!

We've also added a *second whisper quiet cooling fan*. Why? Because whether you add more to your system or not, the cooler it runs, the longer it will last. Now that's *ZEOS value*. Speaking of which. How about UL® listings?

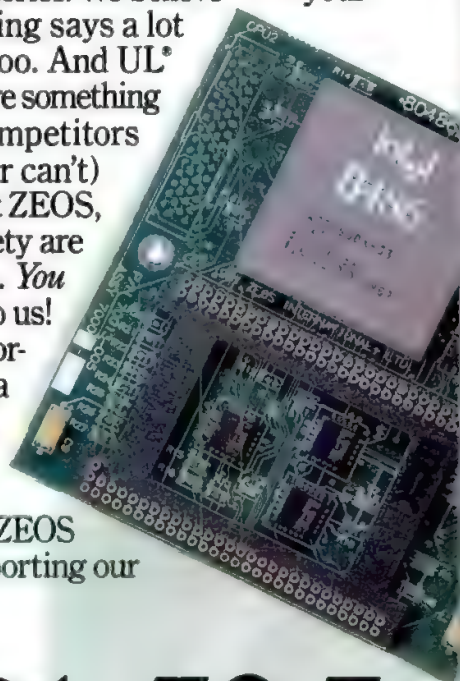
Important to you, and anyone else using your system, is the fact

that every ZEOS system is *Underwriters Laboratories Listed*. This means your entire system (not just the power supply) has met the stringent safety requirements of Underwriters Laboratories. We believe your

ZEOS UL® listing says a lot about quality too. And UL® safety listings are something many of our competitors simply don't (or can't) provide you. At ZEOS, quality and safety are important to us. *You* are important to us!

And the importance of you as a customer shows in many other ways as well.

For example, at ZEOS we believe supporting our



486SX-20! \$1,595

486-33! \$1,795

ZEOS COMPLETE SYSTEM PACKAGE #1

- The Processor and Speed of your choice plus future upgradability!
- 1MB of High Speed 53ns DRAM, expandable to a system total of 32MB right on the motherboard.
- 42MB High Speed IDE hard drive with its own cache.
- 1.2MB or 1.44MB Teac® floppy drive.
- ZEOS 14" flat screen Hi-Res amber monitor with Tilt/Swivel base.
- Shadow RAM and EMS support for enhanced performance.
- ZEOS/RS 101 key SpaceSaver keyboard.
- Two Serial, one Parallel & one Game Port built right onto the motherboard.
- 7-16, 1-8 bit expansion slots. 80387 math co-processor support for '386 systems.
- Rugged ZEOS SpaceSaver case with twin cooling fans for added reliability and product life.
- Seven drive bays and our custom 300 Watt power supply for your future expansion!
- Includes ZEOS 24 Hour a Day Toll Free Technical Support and Customer Satisfaction package.

INCREDIBLE ZEOS PACKAGE #2

We take Package #1 and upgrade your ZEOS Modular System to include:

- 2 full Megabytes of Rip-roaring 53ns DRAM.
- Our incredible 85MB IDE hard drive with its own built in cache.
- Both the Teac® 1.2MB and 1.44MB floppy drives.
- The awesome Diamond SpeedStar Plus VGA graphics card Complete with 1MB DRAM.
- ZEOS 14" High Res VGA Mono Monitor with Tilt & Swivel base.
- Microsoft® DOS plus Microsoft Windows plus a Microsoft Mouse.

Pick Your Package

Or Let Us Custom Build to

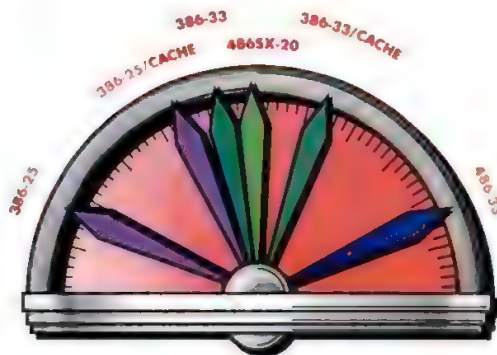
Now, ZEOS lets you pick the power you want for the price you want to pay! And with your new ZEOS modular system, the computer that's right for you today is also the computer that's right for you tomorrow.

You can start by picking the power you need right now. To help you out, we've designed the Z-Speed Meter. You can use the "Z-Meter" to compare the relative performance of each of the processor modules available to you today.

In the future, you can upgrade to even more performance with a new '386 or '486 processor module. And that's only the start of your many ZEOS system advantages. But what more

could there be than dazzling performance, incredible prices and upgradability? From ZEOS there's lots more.

Because your new ZEOS system is not only fast, it's absolutely loaded with features. Like our 300 watt power supply, eight expansion slots, twin cooling fans (for even more reliability) and our unique seven bay SpaceSaver case. And, *every* ZEOS system is UL® listed.



Z-SPEED METER

Let the "Z-Meter" help you pick the processing power that's right for you. The comparisons are easy to make. Fast, Faster or Fastest!

Power, & Price!

Your Exact Specifications.

TAKE YOUR PICK!

	Pkg. #1	Pkg. #2	Pkg. #3	Pkg. #4
386-25	\$1395	\$1995	\$2495	\$2995
386-33	\$1495	\$2095	\$2595	\$3095
486SX-20	\$1595	\$2195	\$2695	\$3195
486-33	\$1795	\$2395	\$2895	\$3395

Add \$200 to any price for a 128K cache.

We think you'll agree, a UL* listing says something not only about safety, but about quality as well!

In addition to all of these standard ZEOS advantages, you're also receiving our legendary ZEOS Technical Support, *24 Hours a Day, 365 Days a Year*. Plus, our 30 day Absolute Satisfaction Money Back Guarantee and more!

So pick your Power, and your Price then give us a call! Your expert ZEOS Systems Consultant is ready to answer any questions you may have. *Why not give us a call right now Toll Free at 800-423-5891.*

INCREDIBLE ZEOS PACKAGE #3

Add even more memory, a larger drive. And more Savings! You now receive:

- 4 full Megabytes of Ultra High Speed 53ns DRAM.
- Our fast 130MB IDE hard drive with built in cache.
- Both Teac® floppies, the 1.2MB and 1.44!
- Your Diamond VGA Plus card with 1MB DRAM.
- ZEOS 14" High Res 1024 x 768 VGA Color Monitor with Tilt & Swivel Base.
- Plus, Microsoft® DOS, Windows and Mouse!

THE ULTIMATE ZEOS PACKAGE #4

Now, Memory goes to 8MB and the drive to 210MB. The ultimate Power User's Dream Machine!

- 8 full Megabytes of High Speed 53ns DRAM.
- Your screaming 210MB IDE hard drive with its own built-in cache.
- Both Teac® floppies, the 1.2MB and 1.44!
- The Diamond VGA Plus color card with 1MB DRAM.
- ZEOS 14" High Res 1024 x 768 VGA Color Monitor with Tilt & Swivel Base.
- Plus, Microsoft® DOS, Windows and Mouse!

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Why ZEOS is

CHECK YOUR EXCLUSIVE

✓ Now, your ZEOS modular system allows you to upgrade from one CPU to another as your computing requirements change. Obsolescence is virtually obsolete!

✓ You may choose between a variety of '386 and '486 processor options, both cached and non-cached.

✓ Made in USA! Your new ZEOS system boards are designed and manufactured by ZEOS, right here in the USA.

✓ ZEOS has utilized the very latest in highly integrated surface mount technology. Faster, cooler, more reliable systems for you!

✓ Every ZEOS modular system comes standard with incredibly fast 53 *nanosecond* DRAM.

✓ Plus, you may expand your system with up to 32 megabytes of memory right on the motherboard.

✓ Your new system features the *exclusive* ZEOS seven bay desktop case, smaller than most five bay cases yet plenty of room for future expansion.

✓ Two whisper quiet cooling fans move more cool air thru your system increasing reliability and component life.

✓ Your *entire* system is UL® listed (not just the power supply). Few others offer this security; we wonder why.

If you're deciding which new computer to buy, there are many important considerations.

Here, we've gathered together a number of these considerations for your review. Some are of obvious importance,

**ZEOS.
Eight Times
Editor's Choice.**

✓ Eight slots, one for the video, seven more open providing plenty of room as your system requirements grow.

✓ Two high speed serial ports, one parallel port and one game port.

✓ Our top quality 300 watt power supply provides you with plenty of power for your present *and* future needs.

✓ ZEOS uses *only* genuine Teac® floppy drives. Accept nothing less.

✓ Monochrome TTL systems feature Genuine Hercules® brand graphics controllers. Only the best for you.

Your #1 Choice!

ZEOS ADVANTAGES!

while others are subtle yet critical to your ultimate satisfaction. We'll go over them here with you one by one.

Please feel free to use these as a basis for comparison with other system vendors. We believe you will come away with the conclusion that ZEOS is indeed Your #1 Choice.

 VGA color systems feature the high-res ZEOS 1024x768 monitor with the incomparable SpeedStar Plus card complete with One Full Megabyte of memory!

 Special package savings are available incorporating our most popular upgrades. Many packages include Microsoft® DOS plus Windows and a Mouse!

 *PC Magazine* said ZEOS offers "more options than even the most configuration hungry hound could possibly need." Let us build whatever you require.

 Everybody loves ZEOS' 24 Hour a Day Toll Free Technical Support. You can call for advice any time of the day or night, 365 days a year!

 ZEOS systems have been selected by *PC Magazine* as *Editor's Choice, Eight Times!* These, along with many other consumer and industry awards attest to ZEOS' consistent and outstanding value.

 Your new system is backed by our 30 Day Absolute Satisfaction Money Back Guarantee, One Full Year Limited Warranty and our Express Replacement Policy.

 Buy with confidence. ZEOS is a strong and rapidly growing public company (NASDAQ Symbol: ZEOS). We've been around since 1981. We'll be around for a long time to come as well.

 ZEOS offers you a wide variety of payment options including MasterCard, VISA, Discover, American Express plus our own Z-Card, the ZEOS credit card featuring low consumer rates. Credit terms are also available along with very attractive leasing programs to qualified corporate customers.

 Friendly, knowledgeable ZEOS Systems Consultants are available 24 Hours a Day by calling 800-423-5891. You can call any time.

When you add it all up, there's nothing like buying from ZEOS. There is certainly nothing like these new ZEOS systems!

**CALL NOW TOLL FREE:
800-423-5891**

Computers Now! SM

Take Your Pick. We'll Ship Today!

RIGHT NOW. GUARANTEED!*

Yes, we can ship your new ZEOS '386 or '486 today! We've built up an extra supply of the hottest selling computers in America in their most popular configurations.

Here's how it works. We have these incredible ZEOS '386 and '486 color VGA systems pre-built and ready to ship. While supplies last, we will ship any of these systems to you *the day you order* subject to these conditions:

1. Your order must be received by 1PM Central Time M-F.
2. Credit Cards are subject to authorization.
3. Orders must be for ZEOS '386 or '486 systems configured as shown here. Any other systems or upgrades are custom built and will take slightly longer.

*OUR GUARANTEE TO YOU:

If we accept your order for immediate shipment and fail to ship your system under the conditions outlined, we will ship it at *our expense* as soon as it is ready.

This offer is good only as long as these pre-built systems remain in stock; please give us a call to verify availability. This offer does not apply to other ZEOS systems or custom configurations.

IMMEDIATE SHIPMENT IS ONLY PART OF THE STORY.

These are not just any computer systems. They're the high performance, high quality ZEOS *upgradable* systems. Packing all the ZEOS value that has won PC Magazine Editor's Choice—*eight times!*

So why not give us a call right now. If we hear from you by 1:00 this afternoon, we'll get your new system on the way to you today! Call now Toll Free 800-423-5891.



**Yes! We can ship
your new ZEOS system
Right Now!
Place your order
by 1:00 PM Central
Time and we'll ship
today. Guaranteed!***

Our most popular '386 & '486 packages! 128K Cache, 130MB Drive, 4MB Memory and More. Ready to ship today!

'386-33 ONLY \$2795.

As a '486-33 ONLY \$3095!

- Upgradable CPU module allows you to change processors as your computing needs change!
- Ultra high speed Zero-Wait 128K SRAM Cache.
- 4MB of Zero-Wait 53ns DRAM, expandable to a Total of 32MB on the motherboard.
- Ultra Fast 130MB IDE Hard Drive.
- 1.2MB and 1.44MB Teac® floppies.
- ZEOS 14" High Res 1024x768 VGA Color Monitor with Tilt/Swivel base.
- High Speed 16-bit Diamond SpeedStar Plus VGA 1024 color graphics card with 1MB RAM!
- Microsoft® DOS with Disk Cache Software *plus* Windows™ 3.0 *plus* a genuine Microsoft mouse.
- Shadow RAM and EMS support for enhanced performance.
- ZEOS/RS 101 key SpaceSaver keyboard.
- High Speed ZEOS I/O with two Serial, one Parallel & one Game Port built in.
- 7-16, 1-8 bit expansion slots. Math coprocessor support for '386.
- Rugged ZEOS SpaceSaver Case with two cooling fans for added reliability and product life.
- Seven drive bays and our custom 300 Watt power supply for your future expansion.
- Includes ZEOS 24 Hour a Day Toll Free Technical Support and Customer Satisfaction package.

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Purchase orders from Fortune 1000 companies, Governments and institutions subject to approval. Leasing programs available. All prices and specifications subject to change without notice. Please call to confirm pricing, specification and warranty details. The following are trademarks of their respective corporations: Microsoft, MS-DOS and Windows of Microsoft Corporation; ZEOS, Computers Now!, SpaceSaver, SuperCase and Z-Card of ZEOS International Ltd. © ZEOS International Ltd., 530 5th Avenue, N.W., St. Paul, MN 55112 USA. ZEOS is a publicly traded company, NASDAQ symbol: ZEOS

Apply Now for the Z•CARD!

NO ANNUAL FEE!

SEND FOR YOUR ZEOS CREDIT CARD



- Low Consumer Rate!
- No Annual Fee!

Now you can send for your own ZEOS Credit Card. It works just like a MasterCard or Visa for ZEOS purchases.

Fill out your Z•Card™ Application and mail it today to ZEOS International, Z•Card Processing Center, 530 5th Avenue N.W.,

St. Paul, MN 55112. We'll give you a call as soon as your credit line is established!*

Please complete all appropriate sections, *providing at least two years residence and employment history*. **THIS IS NOT A CREDIT AGREEMENT!** One will be sent to you upon authorization of an account. (This Form Must Be Signed To Process Your Order.) All Financed Purchases Are Subject To Credit Approval. **If You Have Any Credit Questions, Please Call 800-421-8942 For Assistance. Thank You!**

A married person may apply for individual credit. I am applying for (please check appropriate box):

- ☐ **JOINT CREDIT** with another person. Complete entire application.
- ☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.
- ☐ **INDIVIDUAL CREDIT.** Do not complete Section C.**

**If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract.

NOTICE TO WISCONSIN APPLICANTS: YOU MUST DISCLOSE YOUR MARITAL STATUS:

☐ married ☐ unmarried ☐ legally separated

A. YOUR PERSONAL INFORMATION

Name _____

Home Phone (_____) _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Since? (Mo./Yr.) _____ ☐ Buy ☐ Rent ☐ Other _____

Previous Address _____

City _____ State _____ Zip _____

Employer _____ Since? (Mo./Yr.) _____

Monthly Gross Salary \$ _____ Daytime Bus. Phone (_____) _____

Previous Employer _____ From - To _____

Occupation _____

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Relationship _____

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VISA	_____	_____	Credit Union Account	_____
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Address _____ Apt. _____

City _____ State _____ Zip _____

Home Phone (_____) _____ Date of Residence (Mo./Yr.) _____

Joint Applicant's Employer _____ Since? (Mo./Yr.) _____

Bus. Phone (_____) _____ Monthly Gross Salary \$ _____

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HOW IT WORKS: The Ins and Outs of Scalable-Font Technology

by Edward Mendelson

The heart of a scalable font is its character outlines—ideal mathematical representations of a typeface's letters and symbols. An outline typically takes the form of a path. It begins at a fixed point on the edge of an imaginary box outlining the character and continues through the series of lines and curves that create the shape of the character itself. Outlines are drawn at point sizes large enough to accommodate subtle typographic details: Type 1 outlines are drawn at 1,000 points in size, while Intellifont's outlines are drawn at 250 points.

Suppose you need to print or display a particular instance of a character (say, a 7-point Times Roman *N*). The rasterizer in your printer (or in software such as *Adobe Type Manager*) overlays the character outline on top of an imaginary grid that corresponds to the printer's or monitor's pixel grid, and turns on the pixels that fall within the outline to create a character bitmap. Next, after moving the imaginary pixel grid slightly until it is aligned with the actual pixel grid, the rasterizer "drops" the character onto the page.

FINE-TUNING THE FONTS

The whole process sounds straightforward; on a high-resolution printer or typesetter, it is. But low-resolution desktop printers have too few pixels for the bitmap to approximate a close outline. Any pixel fully enclosed by the outline will be turned on, but sometimes the outline only partially borders some pixels.

That's where the hard work comes in. It is simply not enough for the rasterizer to turn on a pixel if a certain percentage of that pixel is covered by the outline, or if its center point is covered. At low resolutions, brute-force methods like this will result in broken curves and diagonals, and letters like the letter *M* will be drawn with vertically uneven strokes, depending on how the contours of the outline happen to correspond to the pixel grid.

Hinting (Adobe Systems' term; Agfa Compugraphic calls it *scaling intelligence*) is necessary to compensate for these problems. Hints—adjustments programmed into the font files—tell the rasterizer to adjust the bitmap, producing better results on low-resolution devices. One hint might indicate all of a character's same-width strokes, ensuring that the rasterizer will use the same number of pixels for each. The rasterizer may have to shorten or lengthen other strokes to achieve this effect, but the tradeoff is justified by the improved regularity of the resulting letter's shape.

Hinting technologies can also tell the rasterizer to shift strokes slightly along the x- or y-axis to maintain the proper relative size and spacing of the elements that make up a character. Another form of hint called *forced bold* makes the rasterizer draw strokes at least 2 pixels wide when the typeface is bold. Without this hint, the bold and normal weights of a typeface printed at small sizes might use 1-pixel-wide strokes, making them indistinguishable.

At small sizes and low resolutions, the rasterizer has only a few pixels to work with. One unavoidable consequence is a slight but obvious shape variation for a character displayed at different sizes. At 6, 7, and 8 points, for instance, hinting algorithms may result in vertical strokes that are 2 pixels wide. At 9 points, however, these may jump suddenly to 3 pixels wide, making the 9-point characters seem disproportionately thicker and more tightly spaced than the 8-point ones.

TOMORROW'S TYPE TECHNIQUES

TrueType and Intellifont will eventually move beyond today's relatively simple hinting techniques; they will allow digital type designers to program complex scaling and adjustment procedures into the font files themselves. Such capabilities may someday be used for subtle adjustments such as *optical compensation*, in which characters are rendered with slightly different proportions at different sizes to compensate



The core of any scalable-font technology is the rasterizer, which generates a bitmap of a given size from an ideal character outline. Hinting techniques adjust for irregularities that may emerge when producing the dot pattern or matching it to the underlying grid.

for the way the eye perceives large and small type. Optical compensation is not yet part of either the TrueType or Intellifont specification, however, and no type foundry has demonstrated an outline that implements it.

Not all fonts are hinted, and at typesetter resolutions, unhinted fonts work as well as hinted ones (and better than early Type 1 fonts hinted with brute force). At laser printer resolutions, most unhinted Type 1 designs work well only at sizes above 18 points. A partial exception is Intellifont: Though most third-party Intellifont outlines lack hinting support, Agfa's technology uses a very large number of control points to define curves. The lack of hinting seems to have less of an effect on their quality than it does on corresponding Type 1 fonts.

SCALABLE FONTS

open one but has set no timetable). Your only source for Speedo fonts is Bitstream, but fortunately its library, with 1,100 hinted Speedo typefaces scheduled for release by the end of the year, is large enough to suit almost any taste.

Our reviews survey the fonts now available in one of the three widely supported formats. But you can get scalable fonts in other proprietary formats, and these may suit your needs if you are not concerned about being dependent on one vendor for fonts and application support. *MoreFonts*, from MicroLogic Software, is the best of these; it offers dozens of fonts (with a utility to create special textures and other effects), generates them on the fly from *Windows*, *WordPerfect*, and *Microsoft Word*, and can create unhinted *Intellifont* outlines to boot.

Another solution is Atech Software's *Publisher's Powerpak*. This package is notable for its extensive support for non-Latin alphabets and its optimized output on dot matrix printers. Versions are available for *Windows*, *WordPerfect*, *Word*, and Xerox Desktop Software's GEM version of *Ventura Publisher*. Finally, SWFTE International's *Glyphix* offers on-the-fly fonts for *WordPerfect* and *Microsoft Word*. None of these equal the major formats in output quality on lasers. But they can be perfectly acceptable low-cost alternatives to them, provided you are not too picky about such matters.

WAITING FOR WINDOWS

When *Microsoft Windows* 3.1 arrives, it will add yet another player, TrueType, to the list of major scalable-type technologies for the PC. TrueType made its debut last spring in the Macintosh's System 7, so it will have the enormous advantage of

being built in to the two major graphical environments for desktop computers. TrueType offers some theoretical technical advantages over Type 1, notably a larger character set and potentially superior hinting, but whether these will translate into practical advantages remains to be seen. Prerelease samples of the Mono-type-designed TrueType fonts built into *Windows* 3.1 look spectacularly good at 300 dots per inch. On the other hand, these fonts had the benefit of months of fine tuning, and few other fonts are likely to get similar treatment. Rendering speed is also an open question at this point. Every major type vendor except Adobe has announced support for TrueType, however, and it is likely to be Type 1's most significant competitor.

In response to TrueType's challenge, Adobe has announced its Multiple Master technology, a potentially far-reaching development that will allow a single font file to be the source of a range of related typeface designs. Multiple Master fonts will be able to print with different proportions at different sizes, or even expand or contract to fill a page without sacrificing the integrity of their design. A Multiple Master file can contain up to eight separate Type 1 outlines, each pair representing the poles of an imaginary design axis—bold to light, wide to narrow, even serif to sans serif. With suitable software, users can dial up any variation along these axes (for example, a font 60 percent bold and 20 percent condensed).

This kind of technological wizardry may not work smoothly with complex type designs. Many typefaces have distinctive features in different sizes or

weights, and it is often impossible to generate a correct weight simply by interpolating between bold and light. Adobe acknowledges that only a subset of its library will ever make use of Multiple Master, but it is nevertheless an exciting development that may transform digital typography in ways impossible to predict.

IT'S ALL IN THE SOFTWARE

The best typeface technology for you depends largely on the printer you own and the applications you use. If you use a PostScript printer, Type 1 is your obvious choice, but HP LaserJet users have a variety of options. In any case, your programs cannot use your fonts unless they know about them first, so software plays a big part in the choice of one vendor's library over another.

Windows users have the easiest situation; compared with other DOS programs, *Windows* is a type lover's paradise in which (with some limitations) you can choose any typeface and font format you like. All scalable fonts come with *Windows* installers, and all three major formats are supported by *Windows* font managers that scale screen and printer fonts on the fly using scalable-typeface files—*Adobe Type Manager* for Type 1, *Intellifont for Windows* for *Intellifont*, and *FaceLift for Windows* for Speedo. (See "Typefaces Unlimited: Five Font Managers for *Windows* 3.0," *PC Magazine*, April 16, 1991.) *Adobe Type Manager* and *FaceLift for Windows* let you print to any PostScript, HP LaserJet, or dot matrix printer; *Intellifont for Windows* works only with the HP LaserJet III. You can even run all three simultaneously and use three different font formats on the same page. Zenographics' *SuperPrint* is a *Windows*



printer driver that gives you similar flexibility with Type 1, Intellifont, and Speedo fonts, plus its native Nimbus/Q format, but its Type 1 renderings are inexact.

The latest *Windows* HP LaserJet III driver (version 3.77) includes a flexible downloader and installation utility, but the *Windows* PostScript driver (version 3.4b) is more primitive. *Adobe Type Man-*

ager itself lets you use up to 460 Type 1 fonts, but the PostScript driver has an effective limit of 150 fonts, so you cannot use all of these today. Adobe does promise new versions of the PostScript driver with improved font management later this year, however.

LESSER SKILLS

Compared with *Microsoft Windows*, the GEM version of *Ventura Publisher* (the only GEM application with extensive scalable-font support) is much less flexible and elegant. Most Intellifont and Type 1 outlines come with installers for *Ventura Publisher*, but you have to complete the installation by hand by merging the

LOOKING AT FONTS: A Designer's View

by Beth Tondreau

As design spokesman Roger Black once said, by the year 2000 everyone will have a favorite typeface. The differences between typefaces reflect not only the evolutionary history of letterforms but also different sensibilities. Garamond (an old-style typeface named after the sixteenth-century French punch cutter Claude Garamond, who established the first type foundry), conveys an air of crystalline classicism and produces a warmer, more elegant effect on the page than the nonsense workhorse Times Roman.

Garamond stands up well to the indignities of low-resolution printing and is a good choice for digital documents. But as you can see from our samples (printed at 300 dots per inch on an HP LaserJet III with resolution enhancement turned on), all digital Garamonds

Garamond 3 (Linotype)
Garamond 3 Italic (Linotype)
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Adobe Garamond *Adobe Garamond Italic*
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Expert set: HAMBURGEFONTSTIV 1234567890
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Expert set: HAMBURGEFONSTIV 1234567890

Stempel Garamond (Linotype)
Stempel Garamond Italic (Linotype)
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1234567890? ! \$ & % () £ § ß

are not created equal. Subtle differences arise from variations in hot-metal originals and in type foundries' skills. Though these distinctions may seem small, they can significantly affect your page's appearance and mood.

DISTINCTIVE DESIGNS

Garamond is an Old Style typeface, one of a family of typefaces modeled after those used in the early centuries of printing. The digital Garamonds produced by Linotype-Hell and Monotype Typography are based on their own hot-metal designs taken from 16th-century typefaces similar to or derived from Claude Garamond's originals. Linotype's *Garamond 3*, for instance, is based on the 1936 version, which in turn was derived from an original 1917 American Type Founders font design. It is distinguished by authentic angles on the

new fonts' width table with an existing width table.

Among word processors, *WordPerfect* has the richest font support. Thousands of soft fonts are preinstalled into its printer drivers—although you will have to call WordPerfect Corp. or dial into CompuServe for fully equipped drivers in order to supplement the basic drivers that come

with the package. A simple printer definition menu run from inside *WordPerfect* lets you select the fonts that you want to appear in the font menu. To install add-on fonts not already defined in these drivers, you need to use an installer supplied by the font vendor. With *WordPerfect's* PTR

program, you can add only Intellifont outlines, which ship with HP's Autofont metric files. Fortunately, with the exception of some Type 1 font vendors, all vendors ship a *WordPerfect* installer.

WordPerfect is the only application other than *Windows* that lets you mix font technologies, though it does so only in a limited way. Bitstream's *FaceLift* for

crossbar of the uppercase *T*, a low *x*-height, and small counters in the lowercase *a* and *e*.

Though Garamond 3 works fairly successfully in digital form, it has a tendency to lose clarity at low resolutions. For this reason, those producing laser-printed publications may prefer to use **Adobe Garamond**, which is designed specifically for desktop use and remains handsome and serviceable despite the elimination of Garamond's characteristically angular, incised letterforms. Adobe Systems' expert set provides true small caps (capitals of the same size as the *x*-height, which are different in proportion from normal uppercase letters) and Old Style figures, which go far toward improving its typographic flair.

Monotype Garamond is distinctively different by comparison, with a relatively small *x*-height and an open bowl on the capital *P*. The uppercase *A*'s crossbar sits high, the uppercase *K* is expanded and severely angled, and

Garamond Antiqua (Agfa)

Garamond Kursiv (Agfa)

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

1234567890?!\$&%()£\$ß

Simoncini Garamond (Linotype)

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

1234567890?!\$&%()£\$ß

the angles on the uppercase *T*'s crossbar do not point leftwards as noticeably as on other Garamonds. Monotype Garamond shows exceptional finesse in italics, especially with the lowercase *z* and the ampersand. But it

tends to suffer more than others at low resolutions: The serifs on the uppercase *H* come out sickle-shaped.

ALTERNATIVE MODELS

Other digital Garamonds are based on different hot-metal variants. Open bowls on uppercase *Ps*, a slight peak on uppercase *As*, and leftward-slanting crossbars on uppercase *Ts* are the hallmarks of **Stempel Garamond**. This type, based on fonts cut by Claude Garamond himself, was first issued by the German type foundry Stempel in 1924. Stempel-design Garamonds are available from Linotype in Type 1 format and also as **Garamond Antiqua** (in Intellifont format) from Agfa Compugraphic. Linotype's rendition is cleaner than Agfa's, whose letterforms tend to lose the original's angular, incised look (notably in the uppercase *H* and the lowercase *g*'s).

Simoncini Garamond, first issued by the Italian type foundry Simoncini

CONTINUES

Simon's Granite (Digi-Fonts)

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

1234567890?!\$&%()£\$ß

ITC Garamond Book (Adobe)

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

1234567890?!\$&%()£\$ß

WordPerfect lets you use Speedo fonts together with Intellifont and bitmapped fonts on the HP LaserJet III printer, while LaserTools Corp.'s *Fonts-on-the-Fly* package lets *WordPerfect* users who do not have an HP LaserJet III combine Intellifont fonts with the native font format of

their dot matrix or laser printer.

The DOS version of *Microsoft Word* runs a distant second to *WordPerfect* in font support. Microsoft's printer drivers support fewer printers and fewer fonts,

and if you want to customize the font menu, you have to wrestle with *Word*'s archaic MERGEPRD program. You can also use MERGEPRD to install any fonts that come with HP's Autofont metric files and any PC-format Type 1 fonts, but except for a few Type 1 vendors, all font vendors

LOOKING AT FONTS: A Designer's View

CONTINUED

in 1958, is notable for the pronounced slanted-peak tip of its uppercase *A* and also for its graceful italics. Linotype's version of Simoncini Garamond nobly attempts to maintain the design's distinctive characteristics, but Digi-Fonts' version (called *Simon's Granite*), with its squat and shaky letters, is a mere parody of this elegant typeface.

SOMETHING FROM EVERYONE

In 1977, the International Typeface Corporation (ITC), a firm that issues no type of its own but licenses designs to almost every major type foundry, created an informal variant of Garamond distinguished by its large *x*-height. Most font foundries offer versions of this popular typeface. Adobe's *ITC Garamond* is truest to ITC's original design, though a large gap appears between the lowercase *o* and *n* (without kerning), and the curves of the lowercase *o* and the uppercase italics' top serifs are a bit shaky. Bitstream's *ITC Garamond* is a similarly faithful rendition, though a bit clunkier than Adobe's.

All the others deviate significantly from the original ITC design. Digital Typeface Corp.'s *ITC Garamond* is too large, too bold, and too condensed. Image Club Graphics' *ITC Garamond* shows similar sizing problems and a serious case of the shakes, while Digi-Fonts' *Granite* is more angular than the typeface was meant to be. Casady & Greene's odd hybrid (simply called *Garamond*) has the large *x* height of ITC's design but the incised look of the Old Style variants. It is not very successful: The uppercase *B* looks as if it is melting, while the lowercase letters appear very tentative. ■

ITC Garamond Book (Bitstream)
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
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ITC Garamond Book (DTC)
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
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CIRCLE 131 ON READER SERVICE CARD

save you the trouble by supplying their own installer.

THE ART AND SCIENCE OF TYPE

A scalable typeface's quality ultimately depends not on its technology but on its designer's skill. Our reviews show that even fonts based on the same original design and licensed from the same source can look elegant in one vendor's version and crude in another's. (See the sidebar "Looking at Fonts: A Designer's View.") Today's desktop typography far surpasses the scratchy-looking fonts in the first HP LaserJets, but 300 dpi remains a coarse resolution compared to the 1,200 to 3,000 dpi used in commercial printing. When you compare vendors' catalogues to find

SCALABLE FONTS

the best version of a typeface, remember that fonts whose thin strokes and fine curves look beautiful in the catalog may look grotesque on your desktop printer. If you plan to laser print your final output, typefaces with strong, solid designs generally work best. Our reviews should help you identify the vendors whose typefaces are most likely to succeed on your desktop, but be prepared to experiment.

Typeface designs cannot be copyrighted in the United States, though an increasing number of European countries now recognize type designer's rights. But typeface names are legally protected. As a result, your choice is complicated by the

availability of virtually identical typefaces from different vendors under different names—Paladin or Palindrome, for instance, are copies of Palatino. Generally, fonts that use the original name are preferable because the original designer may have some control over the licensee. But this rule is by no means universal—Bitstream's Zapf Calligraphic and Zapf Humanist, for instance, are unlicensed versions of Hermann Zapf's Palatino and Optima that have been publicly endorsed by Zapf himself.

Most typefaces are sold as soft fonts, in packages of up to a dozen faces on one or two floppy disks. You can buy a few scalable-font cartridges for PostScript or the HP LaserJet III (see "Scalable Font



EDITORS' CHOICE

■ Pick and Choose

If you are a graphics professional or corporate publisher, chances are you've already standardized on PostScript and the Type 1 font format. Yet cheaper PostScript upgrades and *Adobe Type Manager for Microsoft Windows 3.0* have made Type 1 the best option for many other business users as well, particularly those with presentation graphics tasks that demand a wide variety of fonts in different sizes.

Indeed, if you ever exchange files with other users or with service bureaus, there is no reason to use anything else. Type 1 gives you by far the widest selection of vendors and typefaces, and this selection will only grow in the future as other vendors, such as Bitstream, enter the marketplace later this year. With near-universal software support (including support from Microsoft's TrueType format), you will never have to worry about losing your investment.

Type 1's dominance of the font field means you have little reason to choose one vendor exclusively over another. You won't go wrong by starting with any of the three major Type 1 font suppliers: Adobe, Linotype, and Monotype. Adobe and Linotype cross-license their entire libraries, in fact, and all three supply Adobe's installation software with their font packages. Three of Adobe's typefaces, Adobe Caslon, Lithos, and Utopia, work well at low and high resolutions, and among Linotype's designs you will find clas-

sic text faces like Frutiger, Granjon, and Sabon, as well as a wide range of display faces.

Monotype's designs, although they are of high quality, don't always look as good as Adobe's and Linotype's at laser resolutions. Ehrhardt, Gill Sans, and Photina are three Monotype offerings that work well at any resolution, and if your output is typeset, consider the subtle Bembo or one of Monotype's imaginative script faces.

Keep an eye open for Bitstream's Type 1 offerings as well, which are due by the end of this year. Our favorite picks are Zapf Calligraphic and Zapf Humanist, which are Bitstream's versions of Palatino and Optima, respectively. Among the smaller vendors, Casady & Greene is notable for its wide range of Cyrillic fonts and its exceptional *WordPerfect* font installer, worth the price of a font disk by itself.

SUITABLE ALTERNATIVES

Though the world of Type 1 fonts has been opened to the vast market dominated by HP LaserJets and compatibles, business users of HP LaserJet III models should by no means ignore that printer's native format. For one thing, Intellifont is significantly faster at rendering fonts than PostScript is, and Agfa's Intellifont offerings are also a good deal cheaper than most Type 1 outlines. To *Microsoft Windows* users, *Intellifont for Windows* delivers screen

fonts at an unbeatable price (free for the asking with every suitable printer), and Agfa fonts are also easily integrated into *WordPerfect*. Most of Agfa's collection is not extraordinary in terms of range or output quality, but its Garamond Antiqua, Gill Sans, and Hiroshige offerings are excellent, and you can also generate unhinted Intellifont outlines from Bitstream outlines by using *Fontware*. Digi-Fonts is a good (though currently ill-supported) source of non-Latin alphabets in this format.

Bitstream's Speedo is the odd format for the PC market. Though *FaceLift for Windows* makes it usable in that environment, Speedo offers no special advantage over the other formats unless it happens to be built into your DOS application. That does not mean that Bitstream fonts are a bad investment, however. You will find plenty of choice in Bitstream's varied library of high-quality designs, and if you already have a large collection of Bitstream fonts in Fontware format, the company offers attractive upgrades. Eventually, all the Bitstream font disks you buy will include Type 1 and TrueType outlines as well as Speedo outlines, so your investment will be well preserved. And as with the other three formats, you can always generate bitmapped HP LaserJet (PCL 4) fonts for use with those applications that don't support scalable technology on the fly.

Cartridges for the LaserJets"), but they tend to offer arbitrary selections of designs that will not exactly fit anyone's needs. For professionals and others who need a large arsenal of fonts, vendors are now beginning to ship fonts on CD-ROM. You can buy most of Adobe's type library, for example, on NEC Information Systems' CD-ROM *Type Gallery*. For \$399 you get the disk and access to 15 fonts; you get other fonts by paying NEC for codes that unlock them; or, for \$12,600, you can start with a fully unlocked disk. NEC has a similar CD-ROM with Agfa Compugraphic's Intellifont outlines (the *Type Library LJ*), and other type vendors promise CD-ROMs for the PC market in the future.

HOW TO PICK THEM

Once you have chosen the typefaces you like in a format that works for you, there are a few other things to consider before you buy. First, make sure the fonts have all the characters you need. The *character set* (also called the *symbol set*) in most typefaces follows standards laid down by Adobe, Hewlett-Packard, IBM, or Microsoft; our reviews warn you about those vendors whose symbol sets do not match these standards. Virtually all Type 1 text fonts have the same 228 characters, which include common commercial symbols and Western European accented letters. Not every application lets you use all 228 of these, however. *WordPerfect* offers the complete set, but *Windows* and *GEM Ventura Publisher* each offer a slightly different subset. For some fonts, Adobe and Monotype supplement the standard symbol set with so-called "expert sets" that contain true small capitals and other characters needed for serious typography. Unfortunately, expert sets are supplied as separate fonts, and existing software cannot always integrate them very smoothly with the standard characters.

HP LaserJet fonts are less standardized than PostScript fonts but often offer a wider range of characters. A few years ago you had to choose among HP's two dozen standard symbol sets when buying your fonts; Bitstream's *Fontware* and HP's *Type Director* now let you generate either bitmapped or scalable HP LaserJet fonts in almost any symbol set you like and

install them in major applications. Older printers and applications favored the 96-character U.S. ASCII set (or their French, German, and other equivalents), but most applications today prefer HP's Roman-8 or Desktop sets, both of which contain 192 characters, including commercial symbols and foreign characters. When you use *Adobe Type Manager* to print to an HP LaserJet, however, you can use only the *Windows* subset of the PostScript symbol set.

Intellifont font disks contain 290 characters in the raw font data used to generate individual fonts, and its font-generating programs (*Intellifont for Windows* and *Type Director*) contain a further 295 symbols that can be added when you create individual fonts. But the individual fonts themselves can contain only up to 256 characters. Speedo fonts contain 560 characters, of which *Windows* can access around 190 and *WordPerfect* can access around 380.

You should also be aware of *ligatures*—connected characters that replace five character pairs (*ff*, *fi*, *fl*, *ffi*, and *ffl*) because the lowercase *f* overlaps other characters awkwardly. Advanced typesetting systems substitute ligatures for the corre-

Kerning tables tell applications to close up excessive space between letter pairs.

sponding letter pairs automatically, but only *WordPerfect* among PC-based systems can perform this trick, and then only when the ligatures and the corresponding letters are in the same font. Intellifont and Speedo fonts contain all five ligatures, but Adobe's symbol set uses just the first two, with the other three relegated to separate expert sets, so using ligatures with Type 1 fonts requires some manual labor.

Another typographic refinement is *Kerning*, which in desktop printing means the adjustment of the visual space between specific pairs of characters to improve their appearance. Almost all scalable fonts come with kerning tables that tell your applications to close up the excessive space between letter pairs such as *W* and *A* or *T* and *y*. Many *Windows*

applications can use these kerning tables, as can *GEM Ventura Publisher* and *WordPerfect*. You may feel shortchanged if a font does not come with hundreds of kern pairs, but you shouldn't overestimate their importance: In hot-metal days, kerning was rare, and nicely spaced characters are as much the outcome of careful character design as of kerning.

Many vendors offer the fonts you need to use, and some offer versions with the quality you prefer to see. But somewhere among these thousands of fonts is the one that communicates exactly what you want to say. When you choose the right type, your readers, clients, and customers will notice, even if only subconsciously, and they will judge you and your words accordingly.

Adobe Systems Inc.

The first scalable typefaces widely available to PC users were Adobe Systems' Times Roman and Helvetica, which were built into the original Apple LaserWriter. These were crude versions of two famous and subtle typefaces, but today Adobe knows infinitely more about producing type. In fact, you can argue that Adobe's most-recent fonts are the best designed of all desktop printing typefaces.

Adobe offers an enormous variety of Latin typefaces (it does not offer non-Latin alphabets outside of Japan). Its *Adobe Type Library* consists of over 1,000 typefaces in 200 packages, each containing 1 to 12 faces and priced from \$95 to \$375. (Selected Type Sets are also available.) This enormous breadth, however, is largely the result of Adobe's licensing of other foundries' designs. Adobe has long had a close cross-licensing relationship with Linotype-Hell, and the two companies issue virtually identical libraries, which use the same font files and installation software. Adobe also issues several faces digitized by Agfa Compugraphic and Monotype Typography, and the company recently announced an agreement with Berthold to distribute that foundry's elegant designs in Type 1 format.

IMPROVING ON THE ORIGINALS

At the same time, Adobe's own type-design group is far from idle. Of Adobe's own typefaces, the best are the Adobe Originals, each designed from the ground up for the best possible results at low and

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Canon



No one will miss dot matrix printers, such a noisy bunch they were. But for a long time, they were the only way to produce decent quality output.

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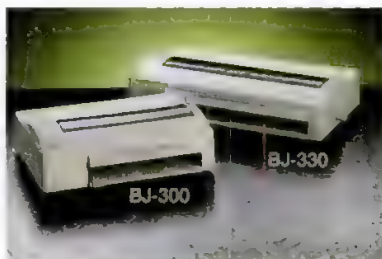
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Best of all, they're every bit as rugged and simple to use as dot matrix printers.

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high resolutions. The earliest of them, Adobe Garamond and Utopia, are strong and effective designs, but they are far surpassed by the latest members of the series, especially Adobe Caslon and Lithos, which rank among the few completely successful typefaces designed for the desktop. Many of the Originals series are supplemented by optional "expert

sets" that include true small capitals, old-style numerals, traditional ligatures, swash italics, and other special characters and ornaments. Later this year the Originals series will also encompass the first fonts to make use of Adobe's new Multiple Master technology—a reissue of Minion

and a new design called Adobe Sans, whose stick-figure simplicity makes it better suited than more-complex designs to withstand this technology's mathematical transformations.

Unfortunately, when you look to PostScript's early typefaces, you will find relatively characterless renderings of classic designs, with unsubtle and sometimes

ADOBE SYSTEMS: A Font Sampler

The quality of Adobe Systems' fonts largely depends on the font package's age. The best are in the new Adobe Originals series, which includes perhaps the best digital typeface around: Adobe Caslon, Carol Twombly's vigorous contemporary revival of a classic eighteenth-century design.

Digital versions of pretwentieth-century hot-metal book faces tend to look spindly, but Adobe Caslon has strength and character at low resolutions without sacrificing subtlety and grace at high resolutions. With a range of weights and (in its accompanying expert set) a full range of small caps, swash characters, and other variations, Adobe Caslon is well suited to straightforward text printing as well as to elegant graphic design.

Three other Adobe Original text faces are also worth your attention. Adobe Garamond, Minion, and Utopia are less vigorous than Caslon, but all hold up well in both high- and low-resolution output.

An earlier generation of typefaces digitized by Adobe are less adept at bridging the resolution gap. Adobe's early rendition of ITC Eras, for instance, is stored in a file that contains a special low-resolution version for laser printers as well as a high-resolution version for typesetters; you cannot overrule the printer's decision to use the low-resolution version. Though the high-resolution version retains the slightly sloped verticals of the original design, the low-resolution version renders these verticals as perpendicular lines, a change that deprives the typeface of the most important reason for its existence.

Unlike Eras, which Adobe adapted for low resolutions, typefaces like Lucida and Stone were originally de-

signed for low-resolution printing. Both now look simpler than needed for today's technology, but Lucida is straightforward and energetic and offers a full supplement of math characters. In contrast, Stone has started a typographic trend by including an "in-

formal" style between its serif and sans serif varieties. Both are excellent all-around performers.

Adobe's library also boasts an imaginative range of display faces. Among them are three striking designs by Twombly: Charlemagne, suggested

Adobe Caslon *Italic* & SMALL CAPS 12345

Semibold Bold *SWASH* *st*   

Adobe Garamond *Italic* & SMALL CAPS 12345

Semibold *Italic* Bold *Italic* *SWASH*

Minion *Italic* & SMALL CAPS 12345 12345

Semibold Bold Black *SWASH*   

Utopia *Italic* & SMALL CAPS   

Semibold Bold Black 12345 12345

ITC Eras Book (low resolution)

ITC Eras Book (high resolution)

Lucida Roman *Italic* Bold *Italic*

Lucida Sans *Italic* Bold *Italic*

Math: ∇ $\mp$ μ $\vdash$ $\approx$ $\oplus$ $\times$ $\mathcal{A}$ $\mathcal{B}$ $\mathcal{D}$ $\mathcal{I}$ $\mathcal{J}$ $\wp$ $\star$

Tekton *Oblique* Bold Bold *Oblique*

outlines, which omit details—the subtle curves of Optima, the slight slope of ITC Eras—that make these typefaces distinctive, even though the same details can be rendered with reasonable effectiveness on today's printers. Adobe won't say whether it plans to replace these early

ineffective hinting. For this reason, you should choose carefully from Adobe's packages. Many of those numbered 60 or below should be avoided, particularly Optima (number 6) and ITC Eras (number 56), each of whose files contains separate outlines for low- and high-resolution printing. Desktop printers automatically select the crudely simplified low-resolution

efforts, so if you want usable 300-dot-per-inch renditions of these two faces, you will have to go elsewhere. This year, for example, Bitstream should make available for the PC its renditions of both faces in Type 1 format.

Other early releases—including the fonts burned into PostScript ROMs—have been touched up a bit since their initial release. Only with ITC Garamond, however, has Adobe gone so far as to issue revised metric files that improve character spacing and kerning. If your service bureau is working from the old version and you have the new one, your line and page breaks will probably come out differently from what you expected. If you work with Adobe's ITC Garamond, it is worth a call to tech support to see if you need an upgrade; then make sure to download the fonts into any PostScript files you send to a service bureau.

EASY INSTALLATION

Thanks to *Adobe Type Manager* (for *Microsoft Windows 3.0* applications) and *Font Foundry* (included in every package for generating bitmapped fonts from Type 1 outlines), you can use Adobe's fonts with printers that have never heard of PostScript. Adobe's installation software takes care of adding your fonts to *Windows*, *Ventura Publisher*, *Microsoft Word*, and *WordPerfect*. When creating bitmap fonts, *Font Foundry* lets you select from a variety of character sets, including standard ASCII (or any user-defined subset), Roman-8, *Windows ANSI*, and the standard set used by *Ventura Publisher*. You can add or replace characters by modifying the undocumented .ENC files that *Font Foundry* uses to define its character sets, but you will have to infer the technique from the files' contents: It is not documented.

Although Adobe's installation software is better than anyone else's, this does not mean it is good enough. The software will not work if you load it onto a hard disk, so each time you install a font you must run the program from a floppy disk and respond to a series of menus that make you type in file locations and other preferences. And though the PostScript driver in *Windows* is capable of downloading soft fonts automatically as needed, you have to edit WIN.INI by hand if you want it to do this, and then it will download fonts each time you print. A *Windows*-based downloader is in the works, as is a more intelligent PostScript driver that will elimi-

by Carolingian manuscripts; Trajan, based on Roman inscriptions; and best of all, Lithos, which combines the effects of ancient Greek inscriptions and modern stylishness. The popular Tekton imitates a contemporary architect's hand lettering.

Finally, Adobe offers some well-drawn specialty typefaces. These include two collections of nineteenth-century American wood types, plus attractive typefaces for printing chess diagrams (Cheq), maps (Carta), and sheet music (Sonata). ■

Stone Sans *Stone Sans Italic*

Semibold *Italic* **Bold** *Italic*

Stone Informal *Informal Italic*

Semibold *Italic* Bold *Italic*

Stone Serif *Stone Serif Italic*

Semibold *Italic* **Bold** *Italic*

TRAJAN CHARLEMAGNE

LITHOS LIGHT **BOLD BLACK**

COTTONWOOD IRONWOOD JUNIPER

Madrone MESQUITE

Birch Blackoak

Cheq        

Carta               

Sonata ♯ $\text{♩} >$ ♩^5 DC. mf L + mp f ∞ 8th 10

nate these gyrations. In the meantime you can use either the bare-bones parallel-port downloader or the more elegant serial-port downloader that comes with each font package.

Adobe's documentation also needs some work. The manual's keyboard charts do not help you with *WordPerfect* or *Microsoft Word*, and the charts for *Windows* and *Ventura Publisher* make sense only when you tear the two pages apart. Fonts with nonstandard character sets have charts correctly printed for *Windows* and *Ventura Publisher*, however.

Adobe's own designs and its licensed Linotype counterparts are the highest-priced Type 1 fonts, but they are the most widely and reliably supported by software and service bureaus, and the Adobe Originals stand at the summit of today's digital typographic art. When building a font library, Adobe's offerings should be among the first you consider.

Adobe Type Library

Adobe Systems Inc., 1585 Charleston Rd., P.O. Box 7900, Mountain View, CA 94039-7900; 800-833-6687, 415-961-4400.

List Price: \$95 to \$375 per package (1 to 12 typefaces each); Carta typeface, \$49; Type Sets 1 or 2, \$99 each; Type Set 3, \$198.

CIRCLE 412 ON READER SERVICE CARD

Agfa Compugraphic

Agfa Compugraphic's *Intellifont Scalable Typefaces* has a different personality depending on which platform you use. If you work with an HP LaserJet III, Agfa offers a growing collection of text and display faces in *Intellifont* format, a hinted superset of the PCL 5 font format developed by Agfa and HP. If you work with PostScript or use *Adobe Type Manager* with any other printer, starting this summer Agfa plans to offer you its separate collection of Type 1 fonts already available for the Macintosh. Agfa's Type 1 collection includes many designs you cannot find anywhere else, and it will soon be enlarged with fonts containing an extended version of Adobe's expert character set, with check boxes, old-style numerals for tabular use, and other symbols normally found only in special-purpose symbol fonts. When *Microsoft Win-*

dows 3.1 appears, Agfa also plans to release these fonts in TrueType format.

As this issue went to press, only the *Intellifont* library was on the market, so

that is what we reviewed. You can buy *Intellifont* faces on single disks with four related typefaces for \$99, or in selected packs of 12 typefaces for \$159 each. Hewlett-Packard sells the same single disks for \$99 and collections with 9 to 26 faces

AGFA COMPUGRAPHIC: A Font Sampler

Although Agfa Compugraphic has created some important typefaces, only a few are currently available in its own *Intellifont* format. The most noteworthy are Garth Graphic, with its distinctive cut-off italic descenders, and Shannon, one of whose two codesigners was later a codesigner of Lucida.

Hiroshige, an elegant calligraphic face, was designed by Cynthia Hollandsworth before she took her current position as head of Agfa's Type Division. Four weights of this design are sold by Agfa in its own *Intellifont* format; Adobe sells the full range of eight weights in PostScript format. Wile

Roman, another readable and original text face designed by Hollandsworth, will appear in the *Intellifont* format soon.

The most striking display face in the *Intellifont* library is Marigold, a unique calligraphic design by Arthur Baker; more calligraphic typefaces by this designer are due to appear in this library. Other attractive *Intellifont* display faces include script designs like Signet Roundhand, Uncial (a typeface based on ancient Irish lettering), traditional designs like Goudy Handtooled, and some of Agfa's many varieties of Letraset Revue. ■

Garth Graphic *Garth Graphic Italic*

Garth Graphic Bold Bold Italic

Shannon Book *Shannon Book Oblique*

Shannon Bold Shannon Extrabold

Hiroshige Book *Hiroshige Book Italic*

Hiroshige Bold Bold Italic

Marigold Signet Roundhand

Goudy Handtooled Uncial

Letraset Revue Light Revue Shado

Albertus Oblique Bold Extrabold

Garamond Antiqua Garamond Kursiv

Garamond Halbfett Kursiv Halbfett

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The **FontBank Cartridge** comes with printer drivers for Word® 5 and 5.5, WordPerfect® 5.1, and Windows® 3.0, and is compatible with bitmapped soft fonts that adhere 100% to HP standards including those from Bitstream®, Agfa®, and Hewlett-Packard. If you own a LaserJet III, IIID, or IIIP printer you can also use PCL5 scalable fonts. The **FontBank Cartridge** requires no extra printer memory and has a list price of only \$299.

If you'd like your soft fonts ready and waiting for you, contact your dealer or Pacific Data Products at
(619) 597-4638,
FAX (619) 552-0889.



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priced from \$159 to \$249. You can also find Intellifont faces in HP's and Pacific Data Products' scalable font cartridges (see the table "Scalable-Font Cartridges for LaserJets").

Most of the 47 disks in the Intellifont library have four weights of standard text faces. These include the 35 PostScript fonts, and popular ITC designs such as the calligraphic Tiepolo (not yet available in most other formats), and Matthew Carter's ebullient ITC Galliard. Agfa's earlier typographic work is represented by uninspired versions of Bodoni and Helvetica, and mediocre imitations of Hermann Zapf's famous Melior, Optima, and Palatino. Under the direction of Cynthia Hollandsworth, however, Agfa's more recent work has far surpassed these earlier efforts, and Intellifont disks with many of the newer designs, plus sets of ornaments and borders, will

appear in the coming months. Agfa also sells Intellifont versions of classic Monotype designs like Gill Sans, and it even offers one more weight of Monotype's Albertus than Monotype itself offers.

PUTTING POSTSCRIPT TO THE TEST

Though Intellifont is not a widely accepted standard like Type 1, the newest Intellifont outlines yield nothing to their PostScript rivals in rendering quality. Intellifont's rasterizing technology has a clear speed advantage and often produces excellent results on 300-dot-per-inch laser printers. In theory, Intellifont's scaling intelligence—its mechanism for maintaining character-shape integrity at all sizes and resolutions—is better than Adobe's hinting, in that it allows control over any element or any combination of elements in a character, rather than a limited set of predefined elements. But neither mechanism proves clearly or consistently superior in practice.

Intellifont disks use a raw format that you must convert into scalable outlines or bitmaps before you can print. Agfa's *Type Director* (\$39.95, but free with most Hewlett-Packard soft-font collections and cartridges) lets you create scalable outlines or bitmapped fonts containing any standard HP symbol set, and it installs them into *Microsoft Word*, *Windows*,

WordPerfect, or *Ventura Publisher*. Agfa's raw format includes a richer supply of symbols than is offered in standard Type 1 fonts, but Intellifont currently has no support for the true small capitals and old-style numerals you can find in Adobe's and Monotype's Type 1 expert sets. (Agfa will supply these with its Type 1 library, however.)

Type Director's ungainly interface is guaranteed to annoy you, and you will be baffled to discover that the program's *WordPerfect* installation cannot install fonts for the HP LaserJet IIIP; if you have

this printer, you will have to circumvent this problem by using HP's autofont installation to create data files that you then load into *WordPerfect*'s PTR program, or you can simply rename the printer driver temporarily via PTR.

Intellifont for Windows is much easier to work with. This utility, which is free for the asking from HP, generates and manages screen and printer fonts using Intellifont outlines and HP LaserJet III printers, just as *Adobe Type Manager* does with Type 1 outlines and PostScript printers. Though this package does not currently work with unhinted third-party outlines from Bitstream, MicroLogic, and other vendors, Agfa has now published the full Intellifont specification, and compatible hinted designs should follow shortly.

With fewer than 200 typefaces available, some of only moderate quality, Agfa's Intellifont library will not come close to rivaling PostScript for the attentions of graphic professionals. But Intellifont's speed, low-priced fonts, and its compatibility with the overwhelmingly popular HP LaserJet III printer make it a format that deserves attention from business users who want a faster and more economical font-scaling alternative to PostScript. And Agfa's fonts are well up to that standard.

Intellifont Scalable Typefaces

Agfa Compugraphic, 90 Industrial Way, Wilmington, MA 01887; 800-424-8973.

List Price: \$99 per package (4 typefaces each); \$159 per font pack (12 typefaces each).

CIRCLE 413 ON READER SERVICE CARD

Bitstream Inc.

No matter what typeface format you need, Bitstream, the first all-digital type foundry, can probably supply it. The *Bitstream Typeface Library* offers 207 well-drawn typefaces in the company's own Speedo format, which ship in 52 \$129 typeface packages with about four typefaces each, and in six \$199 typeface collections, which have 12 faces each. By the end of this year, all of Bitstream's 1,100 typefaces should be available in new packages containing fonts in Speedo and Type 1 formats. Finally, as soon as Bitstream can test the shipping version of *Microsoft Windows 3.1*, you will be able to get the same designs in TrueType versions.

If you cannot wait for the Type 1 or TrueType library, and you use an application that doesn't support Speedo, you can still use Bitstream's first 207 faces. All 52 typeface packages contain, in addition to Speedo, the older .BCO format, which you can convert with Bitstream's Fontware utility into unhinted scalable outlines for your HP LaserJet III or to bitmaps for any HP LaserJet. The scalable HP LaserJet III fonts don't perform well at small sizes but are adequate for most text and display purposes. The typeface packages also contain a .BEZ format, which Fontware can convert into unhinted PostScript outlines, or into hinted outlines compatible with the Pacific Page PostScript emulation cartridges and a few other PostScript-language clones, but not with Adobe's PostScript.

Speedo produces acceptable type on the page, but its real claim to fame is compactness rather than quality. Its character spacing tends to be uneven, and both PostScript and Intellifont often produce smoother and more-readable letters. The on-the-fly fonts created by Speedo do not equal the superb quality of the soft fonts created by Fontware from Bitstream's older-technology .BCO files, although both technologies are rasterizing identical designs. Bitstream's *FaceLift for Windows* lets you use Speedo fonts smoothly

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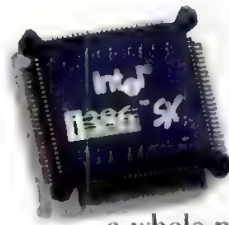
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with any *Windows* application, but if you are fastidious about quality, you may prefer to wait for Bitstream's fonts in Type 1 or TrueType format.

BETTER BALANCE, BIT BY BIT

Bitstream's enormous library is one of the best balanced and most comprehensive of all digital type collections, and with over 560 characters in the Speedo symbol set, it provides enough variety for just about any typographic need.

GRAPHICS SCALABLE FONTS

The 52 typeface packages are dominated by well-drawn renditions of familiar twentieth-century designs like ITC American Typewriter, ITC Avant Garde, and ITC Galliard, and by Bitstream's own versions of Univers (called Zurich), Trump Medieval (called Activa), Antique Olive (called Provence), and Futura. Hermann Zapf's most famous designs appear in versions digitized with the help of Zapf

himself. Only a few older faces, like Baskerville and Garamond, appear in modernized forms.

The full dimensions of the Bitstream library won't be apparent until Bitstream makes its remaining 800 faces available for the PC, however. Unlike the original typeface packages, which are generally limited to four weights of a single typeface family, the full library holds 22 varieties of Univers and similarly extensive sets of many ITC designs, including fur-

BITSTREAM: A Font Sampler

Bitstream's exclusive commitment to digital type results in typefaces that aren't compromises. Bitstream Charter, for instance, was designed especially to withstand the rigors of low-resolution printing, but it has touches of the elegance and insouciance characteristic of earlier nondigital designs by the chief of Bitstream's typography, Matthew Carter. This unfortunately is one of only two of Bitstream's original faces currently available for the PC; the other is Amerigo, a design that may be too nervous-looking for extended use. Carmina, a beautiful calligraphic typeface, should be released later this year in Type 1 and TrueType as well as Bitstream's own Speedo format.

The bulk of Bitstream's library consists of carefully rendered versions of hot-metal or digital typefaces from other foundries. ITC Galliard, for example, is Carter's most famous typeface from his pre-Bitstream career—although his most familiar current one is probably Bell Centennial, a typeface optimized for readability at small point sizes, and used in all recent telephone books. Bitstream worked closely with Hermann Zapf to digitize his Melior (Zapf Elliptical), Optima (Zapf Humanist), and Palatino (Zapf Calligraphic) designs; Zapf has praised the results.

Bitstream's care shows in its treatment of ITC Lubalin Graph; notice the small vertical serif on the lower case *r*, a variant that is found in Herb Lubalin's original designs but is absent from the versions available from other vendors.

Business users can look to Bitstream for the only decent-looking scalable monospaced typeface on the market: Swiss Monospace, a fixed-width variety of Helvetica. Other monospaced typewriter-style designs available from Bitstream include Courier, Letter Gothic, Orator, Prestige Elite, and Script. The six Headlines packages

offer some popular display faces, ranging from the circus-face P.T. Barnum to sophisticated constructions like Blippo Black and Handel Gothic. And the last three examples shown below represent the first of the more than 800 faces that Bitstream plans to introduce to its PC library by this fall: American Text, Embassy, and Stencil. ■

Bitstream Charter *Italic* Black

Bitstream Amerigo *Italic* Bold *Italic*

ITC Galliard *Italic* Bold *Italic*

Zapf Elliptical *Italic* Bold *Italic*

Zapf Humanist *Italic* Bold *Italic*

Zapf Calligraphic *Italic* Bold *Italic*

Hammersmith 521 *Italic* Bold *Italic*

ITC Lubalin Graph Book Demi

Swiss Monospace Roman

Formal Script 421 P. T. Barnum

Blippo Black Handel Gothic

American Text *Embassy* STENCIL

DOS

peck peck peck
peck peck peck
peck peck peck
peck peck peck
peck peck peck
peck peck peck

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peck

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CIRCLE 118 ON READER SERVICE CARD

ther typefaces by Zapf. Display faces like Dom Casual, available elsewhere in at most two weights, will be available from Bitstream in four weights. The depth of the full Bitstream library rivals and sometimes exceeds the depth of the Linotype PostScript library, and Bitstream even offers versions of popular Linotype book faces like Electra and Fairfield that not even Linotype issues in Type 1 format.

Fontware users may be baffled by some of the new names that Bitstream has given to many of its familiar designs. The typeface that Bitstream calls Formal Script 421, for instance, is the same one it used to call Mermaid; every other foundry calls it Ondine. Bitstream's literature does not mention this fact, but some of the more obscurely named Bitstream faces like Aldine 401, Aldine 721, and Humanist 521 (which Bitstream formerly called Hammersmith) are virtually identical to Monotype faces like Bembo, Gill Sans,

and Plantin. Bitstream doesn't offer non-Latin alphabets, true small capitals, or old-style figures, however.

Because the Bitstream library will appear in multiple scalable formats, Bitstream plans enhanced support for all of them. A new version of *FaceLift for Windows*, due this fall, will create screen and printer fonts from both Speedo and Type 1 formats and will speed HP LaserJet printing by creating and downloading bitmapped printer fonts on the fly, instead of rendering them as graphics to be placed on the page. You will also be able to select a variety of fill patterns and shadings.

For years PC users have envied Macintosh users for their access to Bitstream's library of beautifully executed typefaces. Now that Bitstream is at last ready to offer its full library to virtually every application, environment, and printer in the DOS

and Windows world, desktop typography may never be the same. In the meantime, its Speedo offerings give a good range of high-quality fonts to users of DOS applications that support that format.

Bitstream Typeface Library

Bitstream Inc., 201 1st St., Cambridge, MA 02142; 800-522-3668, 617-497-6222.

List Price: \$129 per package (4 typefaces each); \$199 per package (12 typefaces each).

CIRCLE 414 ON READER SERVICE CARD

Casady & GREENE INC.

Major foundries such as Bitstream and Linotype-Hell are like department stores offering a broad range of typefaces. Casady & Greene, in contrast, resembles a small boutique with a limited and specialized stock. Some-

FONT ALTERNATIVES

by Edward Mendelson

The nine vendors we covered in our reviews can supply you with most of the fonts you will need, but additional sources exist if you are looking for that one special font. You can purchase extensive Type 1 font libraries from The Font Company (800-442-3668) and LaCache Software (800-628-8523). Although The Font Company offers 1,600 fonts in Type 1 format, it refused to submit any for review. LaCache claims to offer 15,000 Type 1 typefaces but sent us only two samples, one of which strangely lacked vowels.

The following vendors offer smaller collections of specialized or display fonts:

- Elfring Soft Fonts (708-377-3520) has the only useful hinted Type 1 key-cap fonts for the PC, which sell for \$95.
- FontBank (708-328-7370) sells an imaginative collection of 250 unhinted Type 1 headline and display fonts for \$150 and 75 more for \$75.
- Fonts by Guber (314-991-0318) sells about 150 extravagant headline and display fonts for the HP LaserJet III at \$29.95 each or 4 for \$100.
- Emigre Graphics (415-845-9021) offers 59 stylish display faces in Type 1 format, for \$65 to \$125 per family.



- Kabbalah Software (908-572-0891) offers well-drawn hinted Type 1 Hebrew fonts at \$50 to \$90 per package.

You can find some unusual Type 1 fonts as shareware on CompuServe's DTPFORUM and on other BBSs.

CONVERSION UTILITIES

Another way to obtain fonts for your chosen format is by converting them from another format. But accurate conversion of scalable fonts remains more of a dream than a reality. Because each format uses different geometrical means to represent characters, the conversion process inevitably introduces

distortions—some subtle, some bizarre.

If you can tolerate reduced quality in your fonts, you have a few conversion tools to choose from on the PC. Atech Software's *AllType* converts between Intellifont, Speedo, Type 1, and other formats. ZSoft Corp.'s *SoftType* converts fonts between Type 1 format and its native Nimbus/Q format. Two add-on programs for *MoreFonts*, MI and MT, let you import Type 1 into *MoreFonts*' proprietary format and export to Intellifont, Nimbus/Q, and other formats. With *Refont* (\$20 from Acute Systems, Box 37, Algonquin, IL 60102), you can convert Macintosh Type 1 fonts to PC format.

One kind of conversion that works well for HP LaserJet users is the creation of bitmapped fonts from scalable outlines. Adobe Systems' *Font Foundry*, shipped with all Adobe, Linotype-Hell, and Monotype Typography fonts, converts Type 1 to PCL 4 bitmaps; Hewlett-Packard's *Type Director* does the same for Intellifont outlines, as does *FaceLift for Windows* for Speedo outlines. Though this eliminates the disk space savings and convenience of using scalable fonts directly, it provides high-quality results when other methods fail. ■

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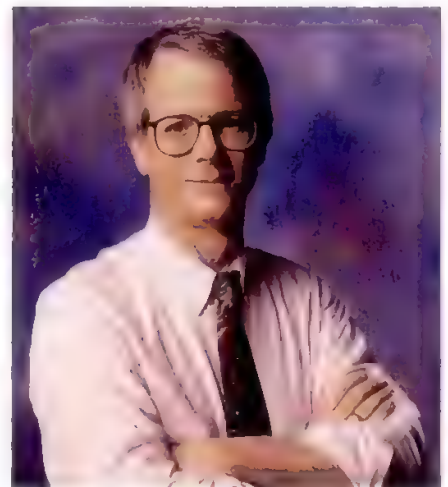
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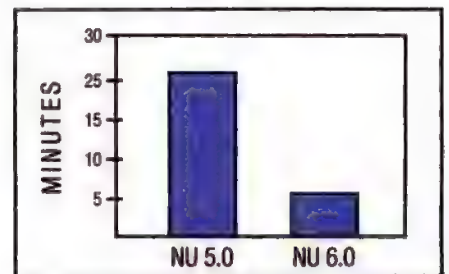
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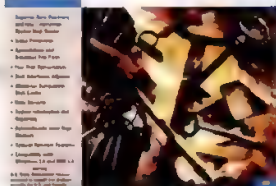
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 - File name descriptions up to 40 characters long
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 - Command line History, Editing and Audit Trails
 - Reduces the amount of memory required by DOS, yet adds over 200 command line options
- Speed Disk is four times faster than NU 5.0
- Faster Norton Cache for DOS and Windows
- Directory Prune and Graft on networks and across drives
- Enhanced Directory Sort, Text Search File Attributes, File Date, File Size, and Line Print
- Full Screen and Quick Command Line Operation

environment with the flexibility of a DOS shell.

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NDOS also supports networks, Windows and DOS 5.0—as well as earlier versions of DOS.

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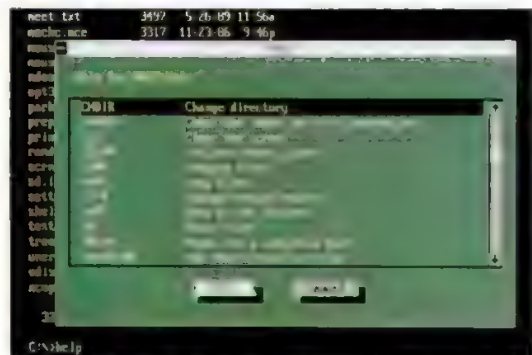
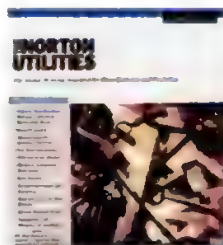
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NDOS provides pop-up, context sensitive help for all DOS commands and reduces the memory used by DOS.

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SCALABLE FONTS

times such a boutique can be the only place to find the font you need.

Casady & Greene's *Fluent Laser Fonts* library offers 79 hinted Type 1 fonts for \$189.95 (TrueType versions will be ready in time for *Microsoft Windows 3.1*). Although this collection offers well-drawn versions of standard text faces such as Bodoni (in 8 weights) and Futura (in 14), you will probably want it most for its unusual script and display faces. These include faces in the style of ancient Irish lettering, faces that successfully imitate ordinary handwriting, three deliberately crude Old West designs, some 1920s-style advertising faces, a collection of highly condensed faces, and a variety of classic calligraphic scripts. You also get a Collegiate face in three varieties (black, outline, and outlined black) that look like the lettering on your college sweatshirt.

The rest of Casady and Greene's Latin alphabet collection comes on single disks with four faces each, priced at \$99.95 to

Slavophiles will be intrigued by Casady & Greene's collection of Cyrillic fonts.

\$140. One disk contains medieval scripts, including a striking modern reinterpretation of initials from illuminated manuscripts. Another disk contains four art nouveau designs that have no parallel in other libraries. Two additional disks contain versions of Garamond that resemble ITC Garamond, but with a smaller x-height. A disk of musical fonts designed by Wendy Carlos is more extensive in its

symbol set than Adobe's Sonata typeface, but the key caps and imitation screen fonts are so clearly designed for the Macintosh that they have little value in the PC world.

UNUSUAL UTILITY

Slavophiles will be intrigued by Casady & Greene's collection of Cyrillic fonts, which is richer than any other PC font vendor's. Separate \$99.95 disks contain Cyrillic versions of Bodoni, Garamond, Helvetica, and Times, in four weights each, while the \$300 Glasnost Collection offers a total of nine Cyrillic faces, including a script and a 1920s-style font. While none of these faces quite matches the strength of Monotype's Cyrillic Times New Roman, all are well crafted faces with a full character set suitable for any modern language that uses the Cyrillic alphabet. Keyboard and printer support for the Glasnost Collection is already built into *WordPerfect's* Russian Language Module.



SCALABLE FONTS: SUMMARY OF LIBRARIES

Companies listed in alphabetical order

	Adobe Systems Inc.	AGFA Compugraphic	Bitstream Inc.	Casady & Greene Inc.	Digi-Fonts Inc.	Digital Typeface Corp.
TYPEFACES						
Number of typefaces in library (as of April 1991)	1,015	200	207	132	396	100
Typeface families (two or more typefaces each)	137	54	40	23	61	19
Latin typefaces	990	197	204	105	316	100
Serif, sans serif	616, 332	100, 66	119, 77	33, 42	160, 87	57, 27
Faces with matching italics	371	79	74	32	64	31
Faces with matching small caps	17	None	None	None	6	None
Script typefaces	32	31	7	31	15	32
Greek typefaces	None	None	None	None	4	None
Cyrillic typefaces	None	None	None	21	3	None
Hebrew typefaces	None	None	None	None	28	None
Commercial symbol and dingbat typefaces	10	3	1	None	5	None
Math symbol typefaces	10	None	2	None	5	None
Music symbol typefaces	1	None	None	2	None	None
Other symbol typefaces	2	None	None	4	33	1
Character set (number of characters per typeface)	228	585	560	228	131	228
Available on CD-ROM	■	■	□	□	□	□
SOFTWARE SUPPORT						
Font file format	Type 1	Intellifont	Speedo	Type 1	Intellifont	Type 1
Hinted	■	■	■	■	□	■
Kern pairs provided	■	■	■	■	□	■
Typical font file size	35K	60K	55K	35K	35K	35K
Installation utility supports:						
Microsoft Windows	■	■	■	■	■	■
Microsoft Word	■	■	■	□	■	■
Ventura Publisher	■	■	■	□	■	■
WordPerfect	■	■	■	■	■	■
Utility to create bitmapped (PCL 4) fonts	■	■	■	□	□	■

■—Yes

□—No

All of Casady and Greene's typeface packages ship with a copy of *Adobe Type Manager* for installation into *Microsoft Windows*, plus a utility for *WordPerfect* installation; *Microsoft Word* users are left to struggle with its MERGEPRD utility. *WordPerfect* installation requires some manual intervention, but the utility (which Casady & Greene unfortunately does not have the rights to sell separately) is the only program in existence that can install virtually any third-party Type 1 font into *WordPerfect*. You will need some knowledge of *WordPerfect*'s PTR program and some courage to experiment with key-strokes before you can tap its power. But a Casady & Greene font disk may be worth the price merely to get your hands on this program—particularly if you want to use shareware or converted Macintosh fonts.

Software aside, better reasons to buy these fonts include their sturdy quality and original designs. The Casady &

OPTIONAL SCALABLE FONTS

Greene boutique is not large, but it is tastefully stocked with well drawn typefaces at bargain prices.

Fluent Laser Fonts

Casady & Greene Inc., 22734 Portola

Dr., Salinas, CA 93908; 800-359-4920, 408-484-9228.

List Price: *Fluent Laser Fonts* library, \$189.95; *Glasnost Collection*, \$300; disks (4 typefaces each), \$99.95 to \$140 each.

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CASADY & GREENE: A Font Sampler

Many of Casady & Greene's typefaces will be familiar, though their names may not be. The California-sounding *Monterey*, for example, is a version of the French *Peignot* typeface, drawn by the great poster artist *Cassandre* in the 1930s. Other Casady & Greene imitations include *Galileo* (based on *Torino*), *Alexandria* (based on *Memphis*), *Micro* (based on *Eurostile*), *Ritz* (based on *Broadway*), *Sans Serif* (based on *Futura*) and *Zephyr Script* (based on *Mistral*).

The exotic display faces in this library are more original, although some, like *Campanile* and *Coventry Script*, resemble standard designs. *Calligraphy* has a distinct personal flavor, while *Dorovar* is an unusual modernization of scripts from the age of Charlemagne. *Jott*, with its variants, can serve as a

straightforward handwriting-like typeface when you want one that looks less sophisticated than Adobe's *Tekton*.

Kells is an uncial face based on the lettering in the ninth-century Irish *Book of Kells*; *Meath* is a more modernized variant. *Gatsby* recollects 1920s typefaces. *Bonnard*, *Epoque*, *Nouveau*, and *Moulin Rouge* are four witty and plausible art nouveau faces—a category that is consistently underrepresented in other libraries.

Casady & Greene's many Cyrillic typefaces more than adequately fill a major gap in the PC Type 1 font market. The three faces shown here are Cyrillic versions of *Garamond*, *Helvetica*, and *Times*. In addition, the *Glasnost Collection* disks include fonts based on *Bodoni* and *Futura*, plus some imaginative script and display faces.

MONTEREY *Italic* MEDIUM **Bold *Italic***

Calligraphy Campanile Coventry Script

Dorovar Carolus Dorovar *Italic*

Jott Casual Quick Bold Quick

Kells Meath Gatsby Demibold Italic

Bonnard Nouveau

Epoque Moulin Rouge

АБВГ Дабвг АБВГ Дабв АБВГ Дабвг

АБВГ Дабвг АВВДГ абв АБВГ Дабвг

АБВГ Дабвг АБВГ Дабвг АБВГ Дабвгд

Image Club Graphics	Linotype-Hell	Monotype Typography
613	1,015	398
124	137	57
612	990	385
285, 235	616, 332	264, 86
174	371	142
None	17	10
39	32	14
None	None	4
None	None	4
None	None	None
None	10	1
None	10	None
None	1	None
1	2	None
228	228	228
■	■	■
Type 1	Type 1	Type 1
■	■	■
35K	35K	35K
■	■	■
■	■	■
■	■	■
■	■	■



SCALABLE-FONT CARTRIDGES FOR LASERJET PRINTERS

Products listed in alphabetical order by company

Bitmapped font cartridges are popular because they let you securely store a variety of fonts inside your printer, avoiding the lengthy downloads and substitution problems often associated with soft fonts. The compactness of scalable outline fonts makes cartridges a less

appealing medium for this technology; moreover, you must install the outlines on your hard disk anyway if you want screen fonts. But a few scalable-font cartridges are available for those who want to extend their printers' native font sets.

	Adobe Systems Inc. Type Cartridge 1: Display Faces	Adobe Systems Inc. Type Cartridge 2: Best Sellers	Hewlett-Packard Co. Distinctive Documents I/ Compelling Publications I	Hewlett-Packard Co. Brilliant Presentations I/ Compelling Publications II
List price	\$395	\$395	\$349	\$349
Printers supported	HP LaserJet II	HP LaserJet II	HP LaserJet III	HP LaserJet III
Additional cartridge required	Adobe PostScript Cartridge	Adobe PostScript Cartridge	None	None
Font supplier	Adobe Systems Inc.	Adobe Systems Inc.	Agfa Compugraphic	Agfa Compugraphic
Number of typefaces	15	18	24	26
Typefaces	■ Bodoni Poster ■ Cooper Black ■ Copperplate Gothic 31 AB ■ Cottonwood ■ Franklin Gothic No. 2 ■ Freestyle Script ■ Hobo ■ Juniper ■ Linotext ■ Lithos Bold ■ Peignot Demi ■ Present Script ■ Stencil ■ Trajan ■ VAG Rounded Bold	■ Adobe Garamond (roman, italic, bold, bold italic, semibold, semibold italic) ■ Bodoni (roman, italic, bold, bold italic, poster, bold condensed) ■ Helvetica Black (roman, oblique) ■ Helvetica Light (roman, oblique) ■ Tekton (regular, oblique)	■ Antique Olive (roman, italic, bold, compact) ■ CG Century Schoolbook (roman, italic, bold, bold italic) ■ CG Palacio (roman, italic, bold, bold italic) ■ ITC Souvenir Demi (roman, italic) ■ ITC Souvenir Light (roman, italic) ■ Stymie (medium, medium italic, bold, bold italic) ■ Univers Bold Condensed (roman, italic) ■ Univers Medium Condensed (roman, italic)	■ CG Bodoni (book, book italic, bold, bold italic) ■ CG Omega (roman, italic, bold, bold italic) ■ Cooper Black ■ Garamond Antiqua (Antiqua, Halbfett, Kursiv, Kursiv Halbfett) ■ ITC Benguiat (book, book italic, bold, bold italic) ■ ITC Bookman Demi (roman, italic) ■ ITC Bookman Light (roman, italic) ■ Letraset Revue Light ■ Shannon (book, oblique, bold, extra bold)
In short	An imaginative selection of headline faces, including Adobe's powerful Lithos; some imitation nineteenth-century wood types; and a great variety of display faces from Linotype.	A selection of Adobe's most popular faces, including the versatile Adobe Garamond (in six weights) and both light and heavy Helveticas to supplement the standard PostScript selection.	A miscellany of text and display faces without a clearly defined purpose. Versions of Century and Palatino are useful if mediocre text faces, and the Univers variants fill out the HP LaserJet III's own selection.	More unusual than its sibling but equally miscellaneous. This cartridge includes AGFA's handsome Garamond Antiqua, plus display faces ranging from the acceptable (Shannon) to the dreadful (ITC Benguiat).

To use one of these cartridges, you must have a Hewlett-Packard LaserJet printer; though PCL-compatible printers can accept HP LaserJet soft fonts, they typically have proprietary cartridge formats that are incompatible with the HP

LaserJet's own. Several of the cartridges are intended for the HP LaserJet III and use that printer's native Intellifont format. Others are PostScript fonts and require matching PostScript cartridges.

Hewlett-Packard Co. WordPerfect Scalable Cartridge	IQ Engineering Super Cartridge 3, Professional Edition	Pacific Data Products Complete Font Library Cartridge	Pacific Data Products Pacific Type
\$349	\$399	\$399	\$399
HP LaserJet III	HP LaserJet III	HP LaserJet III, IIID	HP LaserJet IID, III, IIID
None	None	None	Pacific Page PE
Agfa Compugraphic	IQ Engineering	Agfa Compugraphic	Bitstream
26	40	52	40
■ Albertus (medium, extra bold) ■ CG Century Schoolbook (roman, italic, bold, bold italic) ■ CG Palacio (roman, italic, bold, bold italic) ■ Dom Casual ■ Futura Book II (roman, italic, bold, bold italic) ■ ITC Galliard (roman, italic, bold, bold italic) ■ ITC Zapf Chancery Medium Italic ■ Microstyle Bold ■ Park Avenue ■ Univers Bold Condensed (roman, italic) ■ Univers Medium Condensed (roman, italic)	■ Courier (roman, italic, bold, bold italic) ■ IQE Avgard Gothic (roman, italic, bold, bold italic) ■ IQE Book One (roman, italic, bold, bold italic) ■ IQE Chancellery Italic ■ IQE Dingbats Regular ■ IQE English Blackletter ■ IQE Garamond OS (roman, italic, bold, bold italic) ■ IQE Helv Cond (roman, italic, bold, bold italic) ■ IQE Modern Gothic ■ IQE Palangraphic (roman, italic, bold, bold italic) ■ IQE Schoolbook (roman, italic, bold, bold italic) ■ IQE Univ Cond (roman, italic, bold, bold italic) ■ Prestige Elite (roman, italic, bold, bold italic)	■ Antique Olive (roman, italic, bold, compact) ■ Cooper Black ■ CG Bodoni (book, book italic, bold, bold italic) ■ CG Century Schoolbook (roman, bold, italic, bold italic) ■ CG Omega (roman, italic, bold, bold italic) ■ CG Palacio (roman, bold, italic, bold italic) ■ Garamond Antiqua (Antiqua, Halbfett, Kursiv, Kursiv Halbfett) ■ ITC Benguiat (book, book italic, bold, bold italic) ■ ITC Bookman Demi (roman, italic) ■ ITC Bookman Light (roman, italic) ■ ITC Souvenir Demi (roman, italic) ■ ITC Souvenir Light (roman, italic) ■ ITC Zapf Dingbats ■ Letraset Revue Light ■ Shannon (book, oblique, bold, extra bold) ■ Stymie (medium, medium italic, bold, bold italic) ■ Univers Condensed (medium, medium italic, bold, bold italic)	■ Blippo Black ■ Cloister Black ■ Futura (book, light, light italic, medium condensed, extra black) ■ Futura Stencil Black ■ Goudy Old Style (roman, italic, bold, extra bold) ■ ITC Garamond (book, book italic, bold, bold italic) ■ ITC New Baskerville (roman, italic, bold, bold italic) ■ Park Avenue Roman ■ Slate (medium, medium italic, bold, extra bold) ■ Swiss (light, light italic, black, black italic) ■ Swiss Monospaced Roman ■ University Roman ■ Zapf Humanist (roman, italic, bold, bold italic) ■ Zurich (roman, italic, black, black italic)
A good mix of text and display fonts for word processing and publishing—with or without <i>WordPerfect</i> . Various weights of Univers supplement the HP LaserJet III's native typefaces.	The best scalable cartridge for the HP LaserJet III. This set of unhinted typefaces produces better results than many hinted Intellifont faces. Its selection parallels that of most PostScript printers, but it adds some useful display faces and a fixed-pitch Prestige font that is good for spreadsheets.	A comprehensive cartridge including all the faces in both of HP's cartridges at not much extra cost. But the selection is as miscellaneous as its sources, and decent fonts are combined with several you are better off without.	An extensive, imaginative, and well-designed selection of PostScript faces from Bitstream. Goudy Old Style and Zapf Humanist (a fine digital Palatino) are particularly noteworthy. The fonts are in Bitstream's QEM format, and the results are equal in quality to hinted Type 1 fonts.

GRAPHICS
SCALABLE FONTS

KIRK FITZPATRICK:

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over the full spectrum of moods from traditional to contemporary, including a script face. I cannot judge the quality of Digi-Fonts' Hindi and Gujarati faces, but an expert friend tells me they are exceptionally well made.

Digi-Fonts' typefaces use a non-standard character set that contains foreign accents, the pound sterling symbol, the German double s, and a few commercial symbols. The font header identifies this character set as HP's Legal set, a potential source of confusion to you and your applications. Once you learn how to use the obscure menus in the software in the special effects pack (sold separately for \$149.95), you can generate fonts with standard symbol sets, but the results are uneven; for instance, when you choose the Roman-8 ASCII set, the characters that should have acute accents are overprinted with large paragraph signs instead, and a Greek mu appears wherever the circumflex should be. You can use the same program to add shadows and to rotate or mirror the characters, but the results are too coarse to use for anything except headlines.

Digi-Fonts' installation programs—separate \$39.95 utilities that install your fonts into *Microsoft Windows*, *Microsoft Word*, *Ventura Publisher*, or *WordPerfect*—are not especially helpful. They identify your fonts only by obscure and arbitrary numbers; the *WordPerfect* installer, even after a fix by a Digi-Fonts programmer, failed to install correctly a Roman-8 font created by the special effects program, and the accented character printed in the HP LaserJet's built-in CG Times face instead of the Digi-Fonts typeface. A \$49.95 utility is designed to let you add kerning pairs to font headers, but it crashes often, and what you get on the page does not always match what you see on the screen.

Digi-Fonts offers an unmatched variety of HP LaserJet III fonts (it promises to port them to Type 1 format soon), but its library is not supported the way it deserves, particularly when it comes to installation software. Many of its non-Latin fonts are unique in PCL 5 format, and you might be delighted with Digi-Fonts' unusual characters and symbols, but if you are discriminating about print quality and concerned about ease of installation, you will probably buy your fonts somewhere else.

Digi-Fonts

Digi-Fonts Inc., 528 Commons Dr., Golden, CO 80401; 800-242-5665.

SCALABLE FONTS

List Price: *Digi-Fonts* library, \$599.95; *Digi-Duit* (eight typefaces plus special effects program), \$199.95; font disks (one typeface each), \$79.95 to \$149.95; installation software (*Microsoft Windows*, *Microsoft Word*, *WordPerfect*, or *GEM Ventura Publisher*), \$39.95 per application.

CIRCLE 416 ON READER SERVICE CARD

Digital Typeface Corp.

Digital Typeface Corp. (formerly The Company) is a member of the same corporate family that produces LaserMaster printers and printer controllers. The first installment of its PostScript typeface library, mostly licensed from the URW foundry of Ger-

DIGITAL TYPEFACE CORP.: A Font Sampler

Hermann Zapf says that his new URW Antiqua is based on the familiar Century, but Zapf's deceptively informal face is vastly sophisticated in design. You can get it in Type 1 format, in six weights, only from Digital Typeface Corp. Another typeface unique to DTC's library is Flange, a witty design that looks like a sans serif typeface, but with serifs added in unexpected places, such as the tail of the lowercase g.

Clarendon is just one example of the standard typefaces in DTC's first release. Other familiar names in the library include Eurostile, ITC Clearface, and ITC Clearface Gothic. Dis-

play faces are also familiar, though under unfamiliar names: DTC's Chaucer resembles Cloister Black, Mariage looks like Linotext, and Vivante is a double for Vivaldi. Broadway, Brody, and Old Towne, however, are old favorites that DTC offers under their own names.

Like all other foundries, DTC offers several adaptations of some of the hundred faces designed by Frederic W. Goudy. Its offerings include Goudy Catalogue Italic, an improved version (by Morris Benton) of the popular Goudy Old Style. Oddly, DTC does not offer the roman version. ■

URW Antiqua *Italic* Medium
Medium *Italic* **Ultra Ultra Italic**

Flange Light *Flange Light Italic*

Flange Regular *Flange Italic*

Flange Bold Flange Bold Italic

Clarendon Light **Clarendon Bold**

Chaucer *Mariage* Old Towne

Broadway *Vivante* Brody

Goudy Light *Goudy Catalogue Italic*

Goudy Bold Goudy Heavyface

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language. And unlike PostScript emulators, it gives you true software compatibility. It also gives you twice their speed, plus unlimited type scaling and grayscale shading. At this price, upgrading your LaserJet II to a PostScript printer is nothing to postpone.

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WeCycle Waste Corporation The Materials Research Group Recommendation: FOCUS: ALUMINUM

... research Group provides the
... continue to



WeCycle Waste Corporation

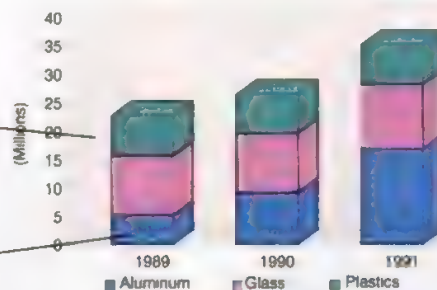
The Materials Research Group Recommendation:

FOCUS Aluminum

This study conducted by the Materials Research Group provides the basis for our most recent recommendation that WeCycle continue to expand its aluminum recycling capacity by another 70% over the next 6 years. The graph to the right shows the increasing proportion of our business provided by the aluminum division during the past three years, now approximately half of all revenues. It is our opinion that, at this rate of growth, aluminum recycling will continue to offer our company its greatest opportunity for expansion over the next decade, and certainly into the 21st century.



Gross Revenues by Product



Glass and Plastics

As can be inferred from the graph to the left, glass and plastics recycling has been holding steady throughout this same period, and has consequently become a smaller proportion of our overall sources of revenue.

Although this group would strongly recommend that WeCycle Waste Corporation do all that is necessary to increase its activities in these areas, our studies have shown that aluminum will become increasingly the material of choice in the shipping, heavy manufacturing and container industries.

Aluminum

It is our opinion that sources of aluminum products will be pressed close to their limits over the next decade.

Therefore, we propose that WeCycle Waste Corporation invest in more aluminum capacity during the next five years in order to take the best advantage of this increasing market demand.

WECYCLE PRODUCT	1989	1990	1991
Aluminum			
Central	1,372,347	2,374,160	4,320,972
West	1,726,492	2,986,831	5,436,033
Total	5,422,265	9,380,518	17,072,544
Glass			
East	2,496,721	2,567,821	2,788,925
Central	3,598,757	3,217,693	3,507,285
West	4,217,635	4,471,294	4,873,710
Total	10,313,113	10,256,808	11,179,920
Plastics			
East	2,897,493	3,171,243	3,234,668
Central	1,873,938	1,823,697	1,880,171
West	2,378,942	1,967,421	2,006,789
Total	7,150,373	6,962,361	7,101,608

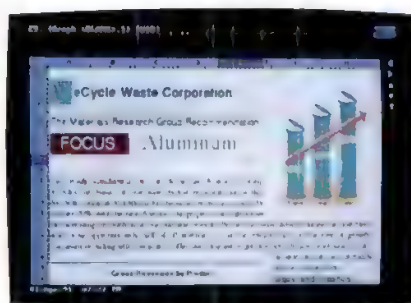
Make your spreadsheet sing your hardware.

There's a lot to like about the new Lotus® 1-2-3® for DOS Release 2.3.

For starters, it's not just a graphical spreadsheet. It's a fast, graphical spreadsheet for DOS. It's easy to use. And it works as well on an older XT with just 512K of memory as it does on the newest 486 machine.

It also shares many features in common with our powerful 3D spreadsheet 1-2-3, Release 3.1. Including its superb spreadsheet formatting and publishing capabilities and full mouse support. Along with its popular Auto Compress feature that gives you a trouble-free way of making larger worksheets print on a single page.

We've also added new features you won't find in other spreadsheets. Like



With its WYSIWYG graphical environment, you can do all your formatting "live" on screen.

the Viewer (based on Lotus Magellan® technology) which lets you view files before retrieving them and makes file linking as easy as point and click. And a very helpful Auditor that simplifies the job of documenting and analyzing worksheet logic.

Of course, you won't just like what Release 2.3 does. You'll like how it feels. It's quick and smooth. With a WYSIWYG (what-you-see-is-what-you-get) graphical environment that lets you format text, data, and graphics "live" on screen. With the mouse, you can execute commands, highlight cells or ranges, open dialog boxes, place and size graphs, change type styles, fonts and point sizes. All with unparalleled speed and ease.

What's more, Release 2.3 gives you a wide range of printing and reporting capabilities. Including the capacity to place as many live graphs on a worksheet as you'd like.

Along with 96 type style combinations, drop shadows, new 3D-effect graphs, drawing and annotation tools, and the most font support, choices of colors and shading available.

Compatibility? As with any 1-2-3 product, it's no problem. Because Release 2.3 will read all of the files you've created on previous versions of 1-2-3, including files you've formatted using Allways™ and Impress.™ So you'll preserve all your work, as well as your training.

For more information see your Lotus Authorized Reseller. For a free demo or to order your upgrade directly from Lotus* call 1-800-TRADE-UP, ext. 6126.



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- A WYSIWYG graphical environment with live on-screen formatting
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- More graph types, including 3D-effect graphs and graph annotation capabilities.
- Auto Compress, for a trouble-free way of making larger worksheets print on single page
- Dialog Boxes for an easier, more interactive way of working
- Text-editing for easy on-sheet word processing, including automatic word wrap, even around graphs
- The Auditor for documenting or highlighting your spreadsheet logic
- Improved memory management for building larger worksheets up to 12 MB in size
- New printer drivers that support all leading laser and dot-matrix printers
- Context-sensitive, interactive Help and an on-line tutorial



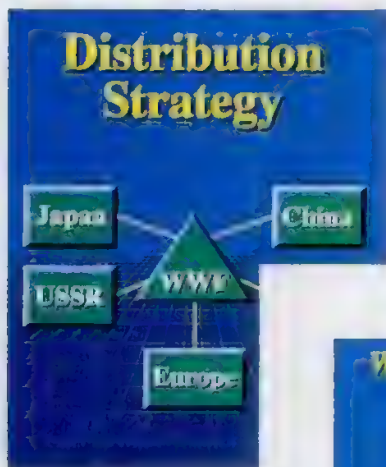
*Please have your credit card and product package ready when you call. In Canada, call 1-800-668-1509.

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The new Lotus 1-2-3 for DOS



Introducing the new It will create your next Not to mention



Automated Smart Features make it easier than ever to produce everything from simple word charts to impressive flow charts, diagrams and other business drawings

The new Freelance Graphics for DOS offers a WYSIWYG (what-you-see-is-what-you-get) environment where you work with actual colors and fonts while you're creating your graphics. And with the mouse you can do it all in record time

Freelance Graphics. presentation beautifully. automatically.

Now there's an even better version of Freelance® Plus, the award-winning graphics program praised by *PC Magazine* and *PC World*. It's so improved, in fact, we even changed its name. Introducing Freelance Graphics™ 4.0. The best presentation graphics program for DOS.

For starters, we've added a graphical WYSIWYG environment. Which means you'll work with actual colors and fonts while creating your graphics. Plus, you'll know what your output will look like before you print.

And with the mouse you'll do it all—from executing menu commands

to moving a chart—in record time. Only Freelance Graphics, with its unique automated Smart Features, can turn your rough ideas into a smooth presentation this easily.

to moving a chart—in record time.

Yet what's really unique about the new Freelance Graphics is its *Smart Features*. Unlike other DOS graphics programs, its hard-working *Smart Features* automate the process of turning your ideas into persuasive presentations. So while

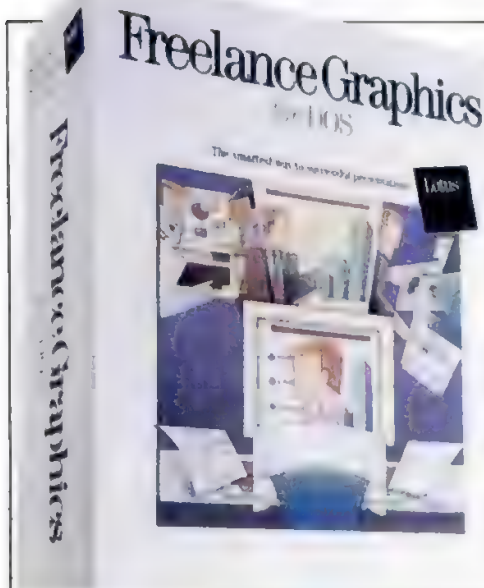
you're concentrating on what you want to say, Freelance Graphics will take care of how it looks. Whether you're creating slides, overheads, or hard copy, in color or black-and-white.

Here are a few of its *Smart Features*:

Portfolio, a built-in presentation manager, helps you organize and prepare your presentation; a **Text Chart Outliner**, complete with a spell-checker, creates stacks of text charts in seconds; **Auto-charting** makes weekly or monthly reporting a snap by printing hundreds of up-to-date charts with a single command; **Smart Chart Update** automatically recomposes a chart whenever the data changes...even if you've added annotations or symbols; and over 1,000 **Pre-drawn Symbols and Design Backgrounds**.

All of which means you can now create an incredibly impressive presentation. With incredible speed and ease. The new Freelance Graphics.

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For information or to purchase your upgrade directly from Lotus, call us. Please have your credit card and eligible product package ready.

1-800-TRADE UP, ext. 6127.

*Developed by Signameter Corporation, especially for Freelance Graphics. Offer expires September 30, 1991, after which the Lotus direct upgrade price will be \$119. *Eligible products for upgrade offer include all versions of the following products: Lotus Freelance Plus or Graphwriter, Harvard Graphics, Draw Perfect, Applause II Draw, Applause Graph Plus, Charisma, Microsoft Chart, Plus, Gen Series, ChartMaster, Diagram Master. (Freelance Graphics 1 parade also available at participating Lotus resellers.)

Freelance Graphics for DOS



many, consists of 100 hinted Type 1 faces. An additional 500 typefaces are due for release by the end of the year, some of them unavailable from other vendors, and TrueType versions of its 335 fonts currently available to OEM customers in its own proprietary Nimbus/Q format will follow quickly. In the meantime, DTC's fonts are remarkable mostly for their low price: The full *DTC MasterWorks Type Library* sells for just \$1,695, which translates to \$16.95 per typeface. Smaller collections and sets, each with from 2 to 16 typefaces, range in price from \$95 to \$295.

By far the most interesting designs in the first 100 typefaces are URW Antiqua, a text face recently designed by Hermann Zapf, and Flange, both available in Type 1 format only from DTC. The remaining typefaces offer fewer surprises. University Roman, the archly fanciful display face found most often on menus, is present in both normal and bold weights. Other type foundries offer only one weight, a number that many graphic designers regard as one too many. DTC also offers a range of other familiar script and decorative faces, including Broadway, Brush Script, and Park Avenue.

Other typefaces in the *MasterWorks* library extend the families built into most PostScript printers. To supplement PostScript's Helvetica, you can choose Sans Condensed and Sans Extended, which are imitations of Helvetica Condensed and Helvetica Extended. A sad echo of the elegant Palatino Light, a scratchy and scrawny face called Palton Light, is a supplement for printing in large sizes. Compared with other foundries' versions of standard faces like ITC Garamond, DTC's versions are almost microscopically less smooth and sometimes have less regular character spacing, but these flaws are usually too minor to bother about if price is a major factor.

DTC finished its first 100 fonts before its installation software, but by the time you read this, it should be shipping with Adobe Systems' installation utility and Font Foundry program, plus *Adobe Type Manager*. At the time of our review, DTC was not an Adobe licensee, but DTC's fonts came with files in Adobe's new .INF format that Font Foundry needs for creating and installing bitmapped HP LaserJet fonts. Before this, only Adobe and Linotype provided these .INF files. With any luck, DTC's decision may start a trend.

It takes time to learn the art of building

GRAPHICS SCALABLE FONTS

a PostScript font, and DTC's first efforts are generally commendable. And with their exceptionally low prices, the *MasterWorks* typefaces may prove to be the first fonts good enough and inexpensive enough to force down the prices asked by the established digital foundries.

DTC MasterWorks Type Library

Digital Typeface Corp., 9965 W. 69th St., Eden Prairie, MN 55344; 612-943-8920.

List Price: \$1,695. Smaller sets and collections with 2 to 16 typefaces each, \$95 to \$295.

CIRCLE 417 ON READER SERVICE CARD

Image Club Graphics

If there is a typeface you haven't been able to find in Type 1 format, chances are you did not look in the *Image Club Typeface Library*. Its 613 typefaces, which range in manner from stern solemnity to

laid-back funkiness, include most standard contemporary designs—plus a few dozen extravagant originals that you never knew you wanted because you could never imagine that anything like them existed.

Image Club's disks come with non-hinted Type 1 files for use with *Adobe Type Manager*, Adobe-licensed printers, and recent PostScript clones, plus older Type 3 files for use with older PostScript clones that cannot handle Type 1. Nine faces, designed to print in gray, come only in Type 3 format. Image Club sells these fonts for \$25 each (the minimum order is \$50), but only in complete families. Display families typically comprise 1 or 2 fonts; text families have up to 12. Discounts kick in for orders of 10 or more, and you can buy the complete library on CD-ROM for \$3,999 (less than \$7 per font).

At these prices you may feel free to experiment with Image Club's more outlandish designs, some of which look less like typefaces than constructions made from paper clips, hairpins, neon tubing, or

IMAGE CLUB GRAPHICS: A Font Sampler

Image Club Graphics' library of over 600 typefaces is a mixture of the familiar and the surprising. In addition to the most common text faces, such as Garamond and Century, you will also find unfamiliar designs like Andrich Minerva. Liberty looks like a classic text face, both the normal roman and the weight called Liberty Outline have open ("inline") spaces within each

stroke. Recent ITC faces, such as Panache, will probably be available everywhere before long, but Image Club has them right now.

Almost all PostScript printers come equipped with Zapf Chancery Medium Italic in ROM. Image Club offers the same design in its roman style as well (which you can also get from Linotype) and even offers (as a separate font) the

Andrich Minerva *Italic*

Liberty Liberty Outline

ITC Panache *Italic* Bold *Italic*

Zapf Chancery Medium *Medium Italic*

Zapf Chancery Medium Swash

American Uncial

SCOTFORD UNCIAL

cutout bits of cardboard. These specialty fonts range in style from three different varieties of comic-book lettering through surfboard-inspired script to an ornate font

Strangely, Image Club's font sizes do not correspond to fonts from other vendors.

that looks like raised metal letters. A MiniPics font consists of clip-art images, dingbats, a scrawled "Oops!," a diagonal "Paid" stamp, and a no-smoking icon. You can produce memorable presentations and headlines with these fonts, though you may not want to use any of them twice.

For more-conventional printing, Image Club's text and display faces cover

MINIPICS SCALABLE FONTS

the whole range of late-twentieth-century typography. They include almost the entire ITC library, plus designs licensed from Monotype Typography and other foundries. You may prefer to avoid Image Club's unlicensed imitations of faces like Optima and Palatino, but knowledgeable desktop typographers will jump at the chance to get the optional swash characters for ITC Zapf Chancery, which are unobtainable from any other PC font vendor.

Most of Image Club's text faces print well at all point sizes despite their lack of hinting, but their finish and detail do not equal the work of the major foundries, and the character spacing in many fonts is uneven enough to be bothersome. Strangely, Image Club's font sizes do not correspond to those of comparable fonts

from other vendors. Image Club's 18-point ITC Garamond, for instance, has about the same x-height as everyone else's 21-point. If you try to combine the swash characters from Image Club's Zapf Chancery with the non-swash characters in the Linotype version, you will find that Image Club's characters are about 15 percent larger than Linotype's at the same nominal point size.

INSTALLATION ECCENTRICITIES

Image Club's installation software is as eccentric as some of its specialty typefaces. The manual bafflingly refers to a program called INSTALL.PAD, but you can probably guess that you should run INSTALL.BAT. The software installs fonts in *Microsoft Windows* and *Ventura Publisher*, but it mistakenly adds PostScript soft fonts to all printers listed in your WIN.INI file, even if, like the HP LaserJet, they can't use them. On my system the software sometimes locked up, and once it truncated my WIN.INI file.

Because Image Club follows Macintosh conventions in naming its typefaces rather than *Windows* conventions, your *Windows* PostScript driver will not be able to recognize the different weights of a single typeface as part of one family. That means that if you want to italicize a few words in a page of Garamond, for instance, you will have to select Garamond Italic from your application's font menu; you won't be able to simply press Ctrl-I to switch to italic as you can with other commercial Type 1 typefaces. Similarly, since Image Club uses Apple Standard character encoding in its fonts instead of Adobe Standard, fractions and some symbols and foreign characters won't print out. The most common accented characters do print correctly, however, and they will probably be sufficient in the vast majority of situations. And by fall Image Club hopes to rerelease its fonts in new versions that correct these problems.

If you want to install Image Club fonts into other programs, you are basically on your own. When, for instance, you try to install them into *Microsoft Word* using Word's MERGEPRD utility, the program rejects them as invalid; you can try to trick the program into installing the fonts (with some characters missing) by running the fonts through *Refont's* conversion routines. During my tests, neither the original nor the converted fonts worked with the *WordPerfect* installation utility that ships

swash characters designed to be used on the opening and closing letters of words or sentences.

Two very different uncials are representative of the range in Image Club's collection. American Uncial, the most famous modern version, combines upper- and lowercase forms. Scotford Uncial is a more conventional all-uppercase design. Image Club's dis-

play faces (some licensed, some original) range from designs that look like LCDs or bamboo shoots to geometric faces made up of stripes, outlines, or shadows. The script typefaces in the library look more like real cursive writing than most such designs. Other display faces include visual puns like Hairpin and Paper Clip, and Rock-A-Billy, an origami-looking extravagance. ■

DIGITAL *Estro* **MAXIMUS**

Franklin Gothic Outline Shadow

Grizzly L&C Hairline hairpin

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SCALABLE FONTS

with Casady & Greene's fonts.

Image Club says its rereleased fonts will look slightly better than current versions, although they won't add hinting until a later version. The Image Club library certainly is not the best choice for ordinary type. But so long as you choose carefully, sticking to Image Club's often amazing display faces, and printing only ordinary keyboard characters in large sizes, its problems are not insurmountable.

Image Club Typeface Library

Image Club Graphics, 102 11th St. SE, #5, Calgary, Alberta, Canada T2G 3G2; 800-661-9410, 403-262-8008.

List Price: \$3,999. Individual typefaces, \$25 each (minimum order \$50); CD-ROM with ten vendor-selected and ten user-selected fonts plus clip art, \$99.

CIRCLE 418 ON READER SERVICE CARD

desktop typesetting. If you already use PostScript soft fonts, it is probable that many of them come from this company. The majority of the more than 200 packages that currently have Adobe Systems' name on the label were in fact designed

Linotype's library contains classic typefaces in graceful and authentic versions.

and digitized by Linotype (now known officially as Linotype-Hell) under cross-licensing agreements with Adobe. Whether it's intended for business or professional use, any serious collection of desktop typefaces is—or ought to be—built largely from Linotype's designs.

The company sells its library in the same packages shipped by Adobe and at the same prices (\$95 to \$370 per package). In addition, Linotype's \$185 Busi-

ness Selection offers seven text and symbol fonts for use with presentations and publications. Each Linotype font package comes with Adobe's installation and Font Foundry utilities so they're relatively easy to use with your applications. Linotype currently supplies almost 2,000 different typefaces in its proprietary format for its high-end typesetters, and virtually all of these will eventually appear in Type 1 format for the PC.

The depth of Linotype's type library is unparalleled. It contains most of the classic traditional and modern typefaces, always in graceful and authentic versions, supplemented by a well-chosen set of script and display faces, plus the widest variety of symbols available on the PC. The range of choices offered by this library are enough to satisfy the most precise typographic needs. For example, Linotype offers no fewer than three different interpretations of Garamond (Garamond 3, based on the American Type Founders version that first popularized this typeface in the twentieth

Linotype-Hell

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century; the rugged Stempel Garamond; and the graceful Simoncini Garamond), plus a fourth, named Granjon, which may be the strongest and most graceful of all. And if you insist on Helvetica, you can choose from over 30 varieties of it, including newly released outline, shadow, and contoured versions. Although these fonts appear as Helvetica on your font menus, they are really a revised family of type called Neue Helvetica, far superior to the Helvetica that comes with PostScript printers.

Among its recent designs, Linotype offers many typefaces by the Swiss designer Adrian Frutiger, including Meridien and Versailles (luxurious text faces), Avenir (based on Futura but redesigned for the digital age) and Frutiger (the subtle sans serif face created for the signs at Charles de Gaulle Airport in Paris). Adobe and Linotype shared the task of digitizing Frutiger's Univers, a less austere and more subtle alternative to Helvetica that is useful for a variety of tasks.

Linotype's experience with digital typesetters has helped it to achieve high quality from the start when it began producing Type 1 typefaces. As with other

SCALABLE FONTS

vendors, Linotype has continued to learn from experience. Some of the earliest Linotype PostScript fonts looked slightly thin on the page, but the latest designs are among the most perfectly suited fonts for desktop printing available.

SUBSTITUTING FOR THE EXPERT

Linotype supplies optional old-style numerals and true small capitals for many of its traditional faces. Unlike Adobe, which offers supplementary expert sets that contain only these variant characters plus refinements like ligatures, Linotype offers a substitute font with a complete alphabet, but with old-style numerals or small caps instead of the conventional characters. The advantage of this approach is that you can use the font with italic old-style figures in place of the ordinary italic (after you juggle some printer drivers), and you will not have to

switch to a separate font containing an expert set every time you want to type an italic numeral. The disadvantage is that you won't get any of the additional ligatures that Adobe includes in its expert sets.

Much of Linotype's current typographic work is based in Germany, and the library includes fonts that are designed for European users but are also useful in American contexts. A package of fonts that conform to the German Industry Standards contains highly legible sans serif

Linotype's experience with digital typesetters has helped it to achieve high quality from the start in its Type 1 typefaces.

fonts useful for signage and other specialty applications. Other packages include "pi" fonts for the German railroads and other European organizations, but they are easily adaptable to American uses. Linotype's Fraktur (traditional Ger-

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man) typefaces each come with two files, one containing the standard PostScript character set and the other with special ligatures needed for German printing. Linotype sells Greek and Cyrillic fonts in Type 1 format for the Macintosh, but it hasn't yet decided whether to release these classic non-Latin designs for the PC.

At the time this issue went to press, Linotype did not include keyboard charts with its symbol fonts and other nonstandard fonts, but it was considering adding them. You may prefer to order these fonts

from Adobe until Linotype adds these charts. The Linotype manual that comes with all its font packages has the same contents as Adobe's; Linotype even reproduces the error in Adobe's manual that reverses the *Microsoft Windows* and *Ventura Publisher* keyboard charts for the standard character set.

For serious professional printing, Linotype's Type 1 library offers hundreds of essential typefaces, each with the long-

established software support available for Adobe's faces. A large proportion of books, magazines, and newspapers are printed with Linotype typefaces. Your desktop printing deserves to use them too.

Linotype Library

Linotype-Hell, 425 Oser Ave., Hauppauge, NY 11767; 800-633-1900, 516-434-2000.

List Price: \$95 to \$370 per package (1 to 12 typefaces each); Business Selection, \$185.

CIRCLE 419 ON READER SERVICE CARD

LINOTYPE-HELL: A Font Sampler

Linotype-Hell evolved from its gritty newsroom origins to create many of the most admired text faces of the hot-metal era. Janson, one of the finest, retains its sturdiness in its digitized version. Like most twentieth-century hot-metal adaptations of classic designs, the Janson family originally consisted only of roman and italic weights. The digital version adds a boldface counterpart, and small capitals and old-style numerals are available on supplementary disks.

Linotype also offers one of the most pleasing members of the Garamond family: Granjon, a faithful historical revival. A more modern member of the same family is Sabon, designed in 1964 as the first type intended from the start to be used with all printing technologies. Walbaum is a slightly modernized version of an early nineteenth-century German typeface, with the thin serifs and strong contrast between thick and thin strokes that are common to typefaces of that era.

Linotype's collection is rich in modern designs. Adrian Frutiger's Glypha, for instance, one of the first typefaces designed at a computer, manages to be simple enough for instant understanding while subtle enough for extended reading. Caxton, by Leslie Usherwood, represents the informality and softness of many text faces designed for electronic printing. Baker Impact, PMN Caecelia, and Signet, some of Linotype's newest faces, exemplify recent design trends.

Linotype's display typefaces include a wide range of revivals. Fette Fraktur is an imposing nineteenth-century design, while Copperplate Gothic is one of many varieties of a titling face by Goudy (note the vestigial serifs). Arnold Böcklin is a sleek contemporary recollection of art nouveau-style lettering, while Auriol,

just released in Type 1 format, is one of the few survivors among typefaces actually created during the art nouveau period.

Among Linotype's large range of script faces are the precise but deceptively informal-looking Mistral; a variety of sixteenth- and seventeenth-century revivals such as Shelley Alle-

Janson Text SMALL CAPS 12345 *Italic*

Janson Bold 12345 *Janson Bold Italic*

Granjon SMALL CAPS 12345 *Italic* Bold

Sabon SMALL CAPS 12345 *Italic*

Sabon Bold 12345 *Sabon Bold Italic*

Walbaum *Italic* Bold *Bold Italic*

Glypha Thin Light *Oblique* **Black**

Caxton Light Book *Italic* Bold

Caecelia Light *Italic* Roman Bold

COPPERPLATE GOTHIC 31AB

Arnold Böcklin Fette Fraktur

Monotype Typography more than anyone else has made the twentieth century a golden age of typography. From the 1920s through the 1960s, Monotype introduced and popularized many of the most readable typefaces in the history of printing. Monotype now sells most of its best designs for

Monotype Typography more than anyone else has made the twentieth century a golden age of typography. From the 1920s through the 1960s, Monotype introduced and popularized many of the most readable typefaces in the history of printing. Monotype now sells most of its best designs for

desktop use in the form of *Monotype Classic Fonts*, one of the most extraordinary Type 1 libraries and the one best suited to exacting typographic demands. Though some of Monotype's fonts need high-resolution printers to fulfill their promise, others can make even the humblest printer perform with a panache you may never have thought possible.

You can buy Monotype's PostScript fonts in over 100 packages priced from

\$90 to \$295, each with two to eight typefaces. Until now, these packages have shipped with Monotype's own installer for *Microsoft Windows* and *Ventura Publisher*, often without kerning pairs. As this issue went to press, Monotype began rereleasing its fonts with Adobe's software and with kerning pairs aplenty. The new release also omits the initial *M* that Monotype formerly added to all its PostScript font names, and the names of the font files have been regularized so you no longer need to rename them for easy installation into *Adobe Type Manager*. Registered users can upgrade for no charge. TrueType releases are scheduled for later this year, and some Multiple Master PostScript fonts will follow.

The flowering of Monotype typeface designs during the 1920s and 1930s was nourished by Stanley Morison, who commissioned historical revivals like Bembo (perhaps the finest modern book face), conceived modern designs on historical models like Times New Roman, and encouraged radically new designs like Gill Sans. The firm also developed witty and striking script and display faces. When photocomposition and digital typesetting began to supplant hot metal, Monotype created some of the most successful designs for the new technology, like Photina and Adrian Frutiger's Apollo. Monotype's most recent typefaces range from stark designs like Abadi, a sans serif suitable for desktop printing, to the elaborate and innovative Ellington, drawn with no straight lines and with a sinuous complexity that desktop printers can reproduce only at large sizes.

For anyone serious about type, Monotype's PostScript library offers indispensable refinements. The historical revivals all have optional expert sets, including alternate forms of characters like Bembo's long-tailed uppercase *R*. Monotype offers versions of Times New Roman designed to be printed at different sizes, and a version with Eastern European accents will appear later this year. Monotype is also the only major vendor with extensive plans to release non-Latin fonts for the PC. Times Cyrillic and Times Greek are already on the market, and two Hebrew faces (complete with bold versions) are due later this year.

Unlike many hinted Type 1 fonts, Monotype's fonts retain the natural variations in stroke weights that maintain the

gro, Shelley Volante, and Snell (all by Carter, who also designed the more contemporary Cascade); Zapf's Medici Script; and the 1950s Nuptial Script, which was designed for invitations. Duc de Berry, Herculanum, and Omnia, the first in Linotype's Type Before Gutenberg series, are based on ancient and medieval scripts.

You can find hundreds of symbols in Linotype's "pi" fonts. The dark arrow in the European Pi sample shown below is made of three characters and can easily be lengthened. Bundesbahn Pi was designed for the German railroad system, but many of its symbols can serve the needs of typographers everywhere. ■

Bundesbahn Pi         



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CIRCLE 525 ON READER SERVICE CARD

full subtlety of the design at high image-setter resolutions, but that often lead to irregular appearance in low-resolution output. This effect is most evident where it matters least: in the screen fonts created

by Adobe Type Manager, where Monotype's tend to look less smooth than Adobe's or Linotype's. Some of Monotype's fonts—notably Bell, Monotype Garamond, Monotype Janson, and Poliphilus—have irregularities included deliberately (a debatable technique even with hot-metal designs). At a resolution of 300 dots per inch, these often produce

overly coarse results on the page.

Monotype's most popular faces, notably Bembo, Gill Sans, and Plantin, are available from Adobe as well, often in versions that differ almost imperceptibly from Monotype's. Adobe's issues have adjustments that make them smoother at low resolutions, and Adobe's designers, with Monotype's approval, sometimes chose slightly different variants of the original design. Adobe's Bembo, for example, resembles the more rounded version that Monotype designed for phototypesetters in the 1960s, while Monotype's version more closely resembles the

Monotype Classic Fonts is one of the most extraordinary Type 1 libraries currently available.

MONOTYPE TYPOGRAPHY: A Font Sampler

Monotype Typography's typefaces include some of the most sought-after designs in modern printing, a unique collection of historical revivals modified for the machine age and modern faces that use a less rigid geometry than many twentieth-century types.

Bembo, based on the 1495 Venetian design used by Aldus Manutius, is both highly readable and subtly characterized: Notice the tiny "beak," for instance, on the lowercase *e*. Poliphilus, based on a slightly later design than Bembo, has a somewhat rougher appearance because Monotype reproduced the irregularities on the original printed page. Its italic has a different name, *Blado*, a reminder that early roman and italic typefaces were not designed to work together.

Monotype's Plantin, a vigorous sixteenth-century book face, deserves to be better known. Monotype has added new weights to this classic design and also offers simpler, narrower versions suitable for newspapers. Times New Roman, a free adaptation of Plantin, is Monotype's original version from 1931, although the italic incorporates slight changes made shortly afterward—changes that are not in Linotype's licensed version of the same typeface. The small-text variant, with relatively wide and tall characters, is especially designed to be legible at 5 points or below.

Monotype's Bell, a late eighteenth-century typeface, is a precursor of so-called "modern" designs like Bodoni that have strong thick/thin contrasts.

Ehrhardt, another historical revival, is a narrower counterpart of Linotype's Janson. Centaur is a freer interpretation of the same original, whose italic is named *Arrighi*. Among the typefaces by the engraver Eric Gill include

Perpetua, Gill Sans (with all its multiple variations), and the elegant and undervalued Joanna (whose italic looks shimmery at low resolution). Monotype's more recent work is represented by Photina, with soft edges designed

Bembo *Italic* SMALL CAPS Semibold

Bembo Bold *Italic* Extra Bold

Poliphilus *Blado Italic*

Plantin Light *Italic* Medium *Italic*

Plantin Semibold *Italic* Bold *Italic*

Bell *Italic* Semibold Bold

Ehrhardt *Italic* Semibold *Italic*

Centaur *Arrighi* Centaur Bold *Arrighi Italic*

Times New Roman *Italic* Bold *Italic*

Times New Roman Medium Small

Perpetua *Italic* Bold Bold *Italic*

Gill Sans Light *Italic* Medium *Italic*

sharp-edged hot-metal typeface from the 1920s. If you plan to use only the standard character set of a Monotype font, the version to choose is partly a matter of taste. But because Adobe does not plan to release Monotype's expert sets, you will only get satisfactory results if you match Monotype's expert sets with Monotype's version of the standard characters.

Monotype's fonts are not for everyone: If you don't use them on the costly high-resolution output devices that equal their demands, much of their subtlety will be lost. But Monotype's designs represent the most distinguished typography of this

SPARTY SCALABLE FONTS

century, and if your work requires the highest degree of quality and refinement, you won't settle for anything less. ■

Monotype Classic Fonts

Monotype Typography, 53 W. Jackson Blvd., #504, Chicago, IL 60604; 800-666-6897, 312-855-1440.

List Price: \$90 to \$295 per typeface package (two to eight typefaces each).

CIRCLE 420 ON READER SERVICE CARD

Edward Mendelson is a contributing editor of PC Magazine. Beth Tondreau is a New York-based graphic designer.

for phototyping, and the new Abadi and Ellington.

Few foundries offer script faces as elegant and energetic as Monotype's; those shown are only a small sampling of its more modern designs. And for the

international market, Monotype's Times Cyrillic and Times Greek, which harmonize perfectly with the Latin Times, are the first faces for a desktop publisher to choose when looking beyond the Latin alphabet. ■

Gill Sans Bold Extra Bold Ultra

Joanna Italic Semibold Bold Extrabold

Photina Italic Semibold Bold Ultra

Abadi Light Medium Italic Bold

Abadi Condensed Bold Condensed

Ellington Italic Light Bold Extrabold

Ashley Script New Berolina

Biffa Script Pepita Script Bold

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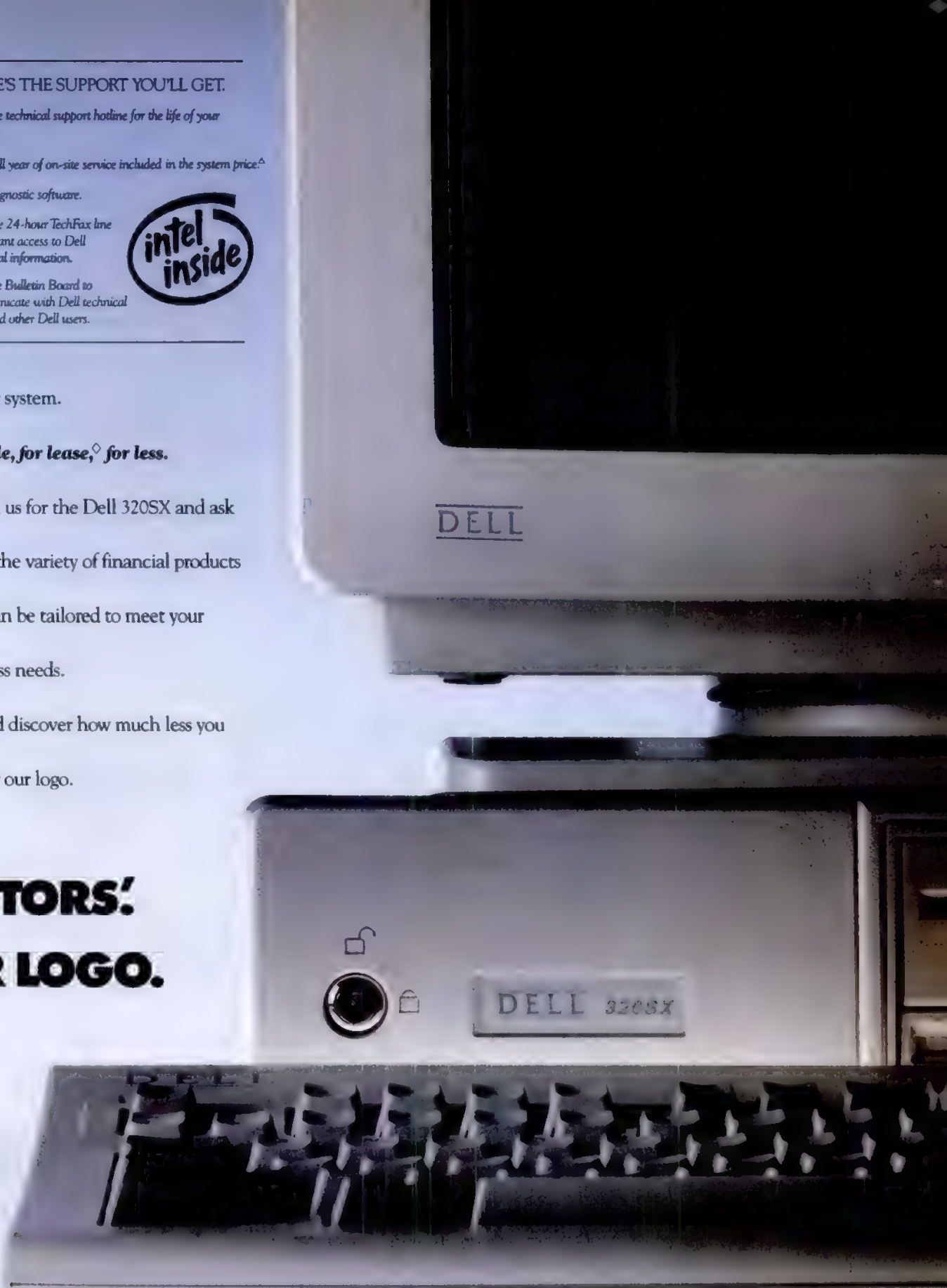
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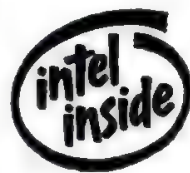
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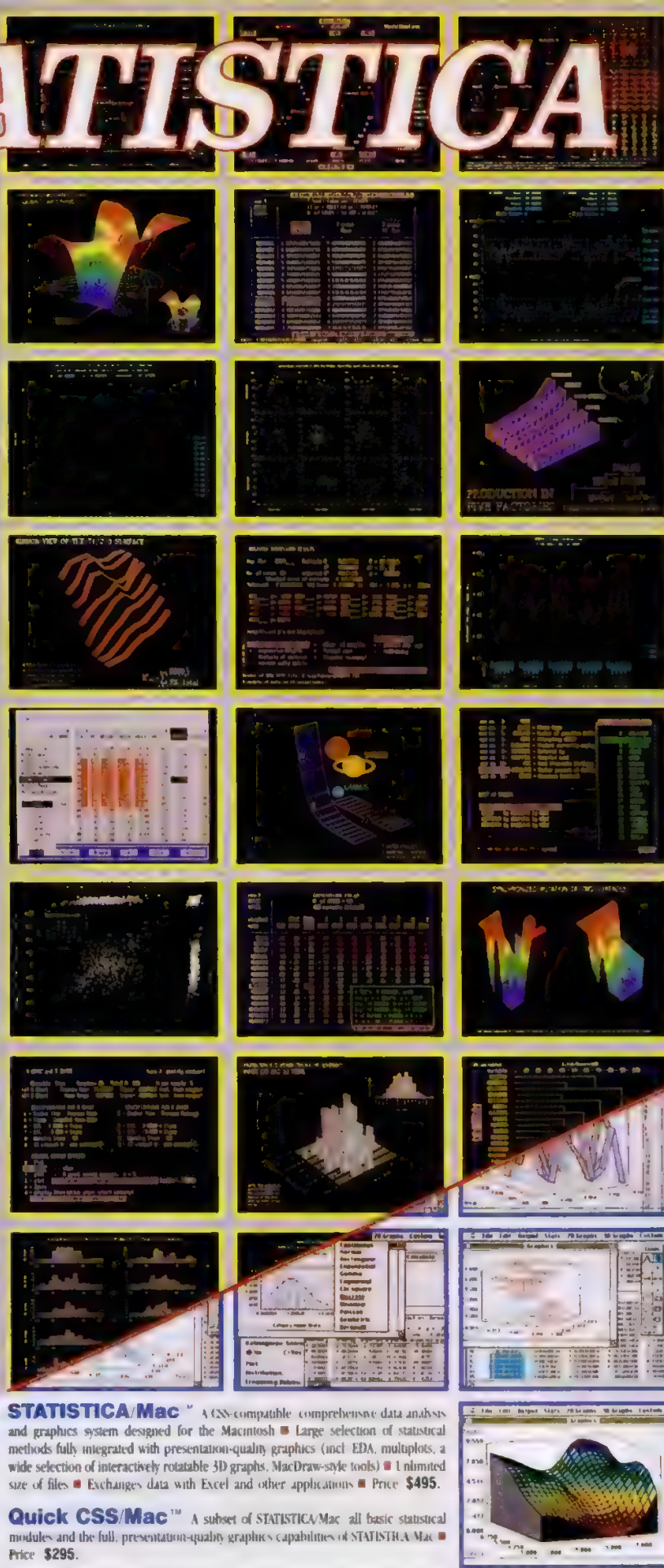


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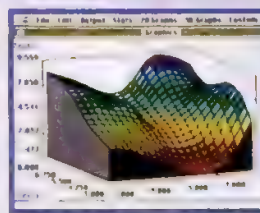
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ISA still dominates the desktop, but EISA is looming. It's already tied with IBM...er, MCA, for network and high-end applications. And as prices tumble, vendors predict that ISA will go the way of the 286.



BUS WARS II: Peaceful Coexistence

by M. David Stone ISA, EISA, or MCA? Making the right choice is easier than you may think. Quite simply, the bus wars are over, and the conventional wisdom stands: ISA remains the bus of choice for most standalone systems and network workstations, while EISA and MCA offer advantages for network servers, computer-aided design, and future niche applications, like multimedia, multitasking, and certain high-end graphics programs.

In the relatively near future, however—perhaps as soon as next year—a shift is bound to occur. EISA and MCA are likely to make their way onto all 386

systems and above, and the battle between EISA and MCA will continue as one between EISA vendors and IBM and a few fellow travelers.

Since the last time we compared the three buses (see "The Bus Wars: ISA's Surprising Staying Power," *PC Magazine*, June 26, 1990), there have been several changes in the real-world aspects of the ISA, EISA, MCA debate. In particular, the price difference between ISA

and advanced bus systems has dropped—to as little as \$500 for similarly configured systems. At the same time, the number of expansion boards that take advantage of EISA or MCA features has grown, as has the number of MCA boards, to match the functions available for ISA and EISA.

Most important, the number of EISA

systems has also grown. Since April, *PC Magazine* has reviewed 22 EISA-based 33-MHz 486 PCs and 20 EISA 25-MHz 486s. Many vendors are even offering EISA in less-powerful systems, including 486SXs and 33-MHz 386s.

Because a PC is usually a five-year investment, and because the 32-bit price premiums have come down so sharply, we felt it appropriate to take another look at the bus wars. For those applications where the advanced buses deliver a performance benefit—a subject we'll come back to—you're probably already buying a high-end machine, with a price of perhaps \$8,000 or more. At that price, the additional cost is typically 5 to 10 percent

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**If you were to talk
to the vendors
today, you would
quickly get the
message that the bus
wars are over.**

◆

of the total, a premium that's well worth paying. If you're buying a less expensive system, however, for an application that won't benefit from the faster bus in any case, there is no reason to pay the price premium.

WHAT BUS WAR?

Talk to vendors today, and you will quickly get the message that the bus wars are over. Instead of claims about the merits of MCA or EISA, you're more likely to hear statements stressing the equivalence of all three buses for today's applications. *PC Magazine* demonstrated the truth of those opinions the first time we looked at the three buses.

What's happened, in part, is what always happens with competing technologies: lots of hype at first, followed by a quieter reality once the products are widely available. Part of the reality is that an advanced bus will not, in itself, improve performance. We have shown, for instance, that by adding a caching disk controller—or a software disk cache—you can improve disk access by many

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times that of a noncached controller.

IBM's description of the MCA bus in early ads for the PS/2 was just about right. A system bus is analogous to a road, and the data that moves over that bus is the traffic. If you have more lanes on the road—or a faster throughput capacity on the bus—you can move more traffic in a given length of time.

The catch is that the extra capacity doesn't help unless you need it. A car can hit its maximum speed on a two-lane country road as easily as on an eight-lane superhighway if there is no other traffic. And data moving over an ISA bus can move just as quickly as on an EISA or MCA bus, as long as you haven't saturated the bus's capacity.

This isn't to say that the buses are all equally capable or that you can expect them all to last indefinitely into the future. Rather, it's a recognition that ISA can still handle most real-world applications. When ISA fades away, it will be a gradual evolution, like the move from AT to 386 and 386SX.

The newfound peaceful coexistence is also a recognition that EISA and MCA are



both here to stay. And, when buying a system, the question is no longer ISA, EISA, or MCA so much as a combination of three intertwined issues: ISA versus either advanced bus; EISA versus MCA as the preferred advanced bus; and, finally, both ISA and EISA versus MCA. Or, more to the point, IBM and one or two fellow travelers.

ISA VS. THE ADVANCED BUSES

Ultimately, choosing between ISA and an advanced bus boils down to questions of price and performance. As already suggested, new applications, from multitasking to multimedia, may yield performance benefits for the advanced buses even on a single-user system. But long before performance issues come into play, the price premium will likely disappear. Once you can buy a system with an ad-

WHERE TO FIND IT: EISA and MCA Cards

IBM, Compaq, and other manufacturers offer resources to make the search for specialty EISA and MCA cards easy.

To find a particular MCA adapter, take a look at IBM's National Support Center Bulletin Board System. This BBS lists more than 1,000 adapters from IBM and others and is updated monthly. The phone numbers are 404-835-6600 for 2,400 bps, 404-835-6296 for 9,600 bps with a Hayes V-Series Ultra Smartmodem 9600, and 404-835-5300 for 9,600 bps with a Courier HST Dual Standard modem. Set your software to 8 data bits, 1 stop bit, no parity.

There is no central clearing house for such information on EISA, but most EISA vendors maintain their own lists of boards. Compaq's customer support staff has access to one such list; the phone number is 800-345-1518. (You don't need to be a Compaq customer to call.) ■

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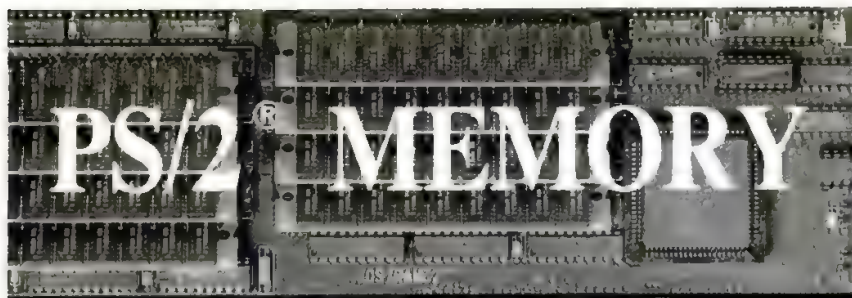
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COMPUTERS

ISA, EISA, MCA

vanced bus for the same price as an ISA system, there's no reason to stay with the lesser bus.

Even today, most of the apparent price difference between EISA and ISA systems has more to do with configuration than with the bus. Northgate, for instance, sells a 486/25 EISA and 486/25 ISA for an advertised price difference of about \$2,200. However, if you match the systems as closely as Northgate's options permit and make allowances for the remaining differences in cache RAM and power supply, you'll find that the two systems actually differ by \$500.

Even IBM is starting to minimize the gap between ISA buses and advanced buses, particularly with the recent introduction of the PS/2 Models 40 and 57. The systems are remarkably similar, differing primarily in their bus, with ISA for the

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between an ISA and
an advanced bus
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of price
and performance.**

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Model 40 and 16-bit MCA for the Model 57. Since both systems are built around the 386SX, the MCA bus in this case is 16-bit rather than 32-bit. But it's interesting to note that if you equip both systems with an 80MB hard disk, 4MB RAM, and matching floppy disk drives, the prices are \$4,115 for the ISA system and \$3,888 for the MCA. This is not a misprint: The ISA system is \$227 more than the identically equipped MCA system. IBM keeps the ISA price down by offering a base model with less RAM and a lower-capacity hard disk than on the base-model MCA system.

Some EISA systems also cost less than some ISA equivalents. ALR is selling one of its EISA systems for about \$2,000, well below anybody's idea of a high-end price. And Memorex-Telex sells an EISA 486SX for a list price of about \$1,000 less than the company's equivalently equipped ISA 386/33 (though it comes with five ex-

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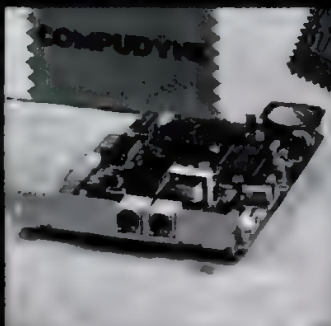


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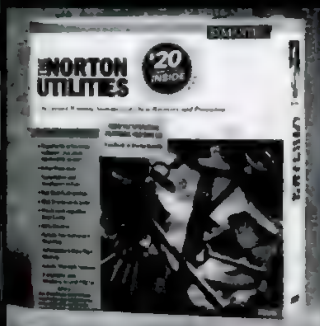


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pansion slots instead of seven).

And EISA prices are about to drop further. One of the major reasons for the price difference between EISA and ISA systems has been Intel's first-generation EISA chip set. This two-chip package needs a great deal of support logic, leading to as many as 100 chips on an EISA motherboard.

According to Intel, the company's second-generation chip set, a seven-chip package that is just becoming available will reduce the number of necessary support chips on the motherboard to about 40 and diminish manufacturing costs accordingly.

Other chip manufacturers are beginning to offer competition as well. OPTi, for one, claims that motherboards designed around its new chip set will be even less expensive than those designed around the second-generation Intel chip set.

Some vendors predict the price difference between comparable EISA and ISA systems could fade to zero as soon as December.

As of this writing, the new chip sets have yet to affect prices. Northgate's EISA price, for example, reflects the inclusion of the original EISA chip set. In the most optimistic prediction from any of the manufacturers we talked to, Tom Roxburgh, vice president of sales and marketing at Northgate, suggested that the difference in price between identical ISA and EISA systems could fade to zero as quickly as December 1991.

Others agree with the conclusion, if not the time frame. An Acer representative expects the ISA price advantage to disappear, and manufacturers to start standardizing on EISA—even for 386-based systems—by mid-1992. An Intel representative suggested that the price difference would continue until the third-generation Intel chip set, roughly two years away.

Clearly, the clock is ticking on the ISA bus. And you'll want to keep a close eye

ISA, EISA, MCA

on relative prices when you're making a buying decision.

TESTING ISA'S LIMITS

In theory, EISA and MCA have two performance advantages over ISA: Faster throughput and bus mastering. Both are more significant in the network environment, where the computer is working the hardest, but have little effect on existing

single-user applications.

ISA's maximum throughput is 4MB per second; EISA's is 33MB per second; MCA's, for most configurations, is 20MB per second—though some adapter cards can manage as much as 80MB per second, and IBM has made claims that the bus may allow a maximum of 160MB per second (see the sidebar "Micro Channel II: Faster Throughput on the Horizon").

Bus mastering lets an adapter take control of the bus to transfer data. Without

BUS ARCHITECTURES: WHAT 25 TOP VENDORS ARE PRODUCING

EISA has picked up speed at the 33-MHz 486 level, though ISA production still dominates all other categories. Only IBM, ALR, and NCR produce Micro Channel (MCA) systems. Here's what 25 key vendors will sell you if you're looking for a fast 386, 486SX, or 486 PC.

	386/25	386/33	486SX/20	486/25	486/33
Acer	I	I	I	I/E	E
ALR		E/M	E/M	E/M	E/M
AST	I	I			E
AT&T	I	I			E
Austin	I	I	I	I	E
Compaq	I	E		E	E
CompuAdd	I	I		I	E
Dell	I	I		E	E
Epson	I				
Everex	I	I		I	I/E
Gateway 2000	I	I		I	I
Hewlett-Packard	I	I		E	E
Hyundai	I	I			
IBM	M		M	M	M
Memorex Telex	M	I		M	
NCR				M	M
NEC	I	E		E	
Northgate	I	I	I	I/E	I/E
Packard Bell	I	I		I	
Tandy/GRiD	I	I			
Unisys		I		I	
Wang		I		I	E
Wyse	I			I	E
Zenith	I	E		E	E
Zeos	I	I		E	E

I—ISA

E—EISA

M—MCA

A blank box indicates that the vendor does not market a system of this type.



BENCHMARK TESTS: ISA VS. EISA VS. MCA

Since even the ISA bus is impossible to saturate, there is virtually no difference in actual throughput among the three architectures. However, without bus mastering and with a relatively narrow bandwidth, the AT-bus system's CPU needs to work the hardest. These factors put ISA at a disadvantage.

WHAT THE GRAPHS MEAN

Stop looking for the fastest bus among EISA, ISA, and MCA for your standalone PC: PC Magazine Labs' network tests show data throughput to be identical for all three bus architectures—provided that your processor has enough horsepower.

With one network interface card (NIC) loaded into each of our three competing 486-based machines, each machine performed our Network Speed Load, Hard Disk Access Load, and Directory Access Load tests at much the same speed as the other machines. Each moved the same amount of data and performed the same amount of CPU work regardless of how many workstations were active on the network at the time.

Even our ISA system (the ALR PowerCache 33/4e with ISA components), with its 16-bit bus and its limited bus-mastering capabilities, handled our tests with processing power to spare. At the same time, the ISA system did show consistently higher CPU usage than the 32-bit-bus EISA or MCA systems. With the installation of a second NIC, our tests gave a better picture of the limitations of the ISA bus, especially on networks of 16 and 32 workstations.

THE MULTIWORKSTATION CATCH

Although we found no real differences among the three architectures when we ran the Hard Disk Access Load test, we noticed some strain on the ISA system even with two NICs installed. This test shows how quickly data can move along the bus to and from a noncached hard disk subsystem.

The limitations of the SCSI adapter and drive system we used in all three machines allowed the ISA system to keep pace with both the EISA and MCA systems. However, the ISA system required more CPU power to perform the Hard Disk Access Load test with two workstations active than either the EISA or MCA system required with 32 workstations active. And if you use a caching controller or a high-speed drive array system, or both, your EISA or MCA system will achieve higher throughput than the ISA system.

The Network Speed Load test (once again, with two NICs loaded) showed much the same pattern. The ISA system kept up with the EISA and MCA systems up to about 16 workstations. Going to 32 workstations with two NICs required all the CPU power our ISA system could muster to keep the data moving across the bus. As a result, its throughput for 32 workstations fell off in comparison with the EISA and MCA systems, which achieved nearly identical throughput and had CPU capacity to spare.

We found the same results when we ran our Directory Access Load test, which requires a great deal of processor overhead. The ISA system's CPU hit its maximum load with 16 workstations. It took double that number of workstations to make the EISA and MCA systems' processors begin to breathe hard. For high-traffic networks running server-based applications, the clear file-server choice is an EISA or MCA system.

bus mastering, control has to come from some combination of the system CPU and DMA controller. With bus mastering, the bus mastering adapter does the work, and the CPU is freed up for other tasks.

The ISA bus has a limited form of bus mastering that lets one bus-mastering card operate effectively in the system. And indeed, most high-performance ISA SCSI adapters take advantage of this feature. EISA and MCA have their own separate, more-sophisticated bus arbitration schemes that allow multiple bus-mastering cards—with up to 15 bus masters in MCA and up to 6 in EISA.

Bus mastering and faster throughput are clearly desirable if you need them, but the issue is whether you really need them. The central question is, What does it take to saturate an ISA machine? To answer that—and to compare the three buses—we ran the *PC Magazine* network benchmark tests with closely matched ISA, EISA, and MCA systems operating as servers for a 32-node token-ring network.

In these tests, 31 of the PCs put various workloads on the network server while one workstation runs a throughput test. The results show the total work handled by the network server, the throughput on the single workstation, and the percent of time the CPU is busy for each test.

The server workloads vary in both kind and amount, depending on the test (see the sidebar "How We Tested"). We tested the servers under three kinds of workload. The Hard Disk Access Load test is designed to force disk access between the server and the workstations. The Network Speed Load test, in which the workstations write to and read from a disk cache (thereby avoiding disk access), indicates raw interface speed and file-server capacity. The Directory Access Load test puts a heavy load on the CPU by having each active workstation look for a nonexistent file on the server.

For each kind of load, the tests measure five different levels of load, with 1, 3, 7, 15, or 31 stations actively loading the network. In addition, for each kind and each level of workload, we ran the test using first one, then two network interface cards.

Preliminary tests with identically configured Everex STEP PCs (one ISA and one EISA) demonstrated that ISA cards offer the same performance whether plugged into an ISA or EISA bus. To keep the test systems as similar as possible, therefore, we used the same ALR PowerCache 33/4e, configured first with EISA

HOW WE TESTED

by Robert Kane

OUR CONTESTANTS

To compare performance among the EISA, ISA, and MCA buses, we looked for three systems that were identical in everything but their architectures and configured them with comparable disk and network controller cards.

Since no manufacturer sells an EISA, an ISA, and an MCA computer at the same processor level, we substituted as closely as we could. We chose two ALR PowerCache 33/4e systems; we equipped the first with ISA cards and the second with EISA cards. An IBM PS/2 Model 90 equipped with MCA cards was our third system.

All three PCs contained 33-MHz 486 CPUs and 8MB of memory. The ALR systems came with 128K of 25-nanosecond external processor RAM cache, while the IBM PS/2 Model 90 contained a 256K/20-ns. cache.

Matching components was easier. Each machine had a Maxtor XT-8380S SCSI hard disk with a formatted capacity of 339MB and an average access time of 14 milliseconds. Bustek Corp. supplied bus-mastering disk controllers that varied only in their interface to the system bus. We used the 16-bit BT-542B, 32-bit BT-742A, and 32-bit BT-640A models for the ISA, EISA, and MCA systems, respectively. These boards use the same chip sets, BIOS versions, and firmware revisions, and Bustek's Version 1.0 driver for *NetWare* 3.1.

The Madge Networks supplied bus-mastering Token-Ring network interface cards (NICs) for all three systems: the Madge Smart 16/4 AT Ringnode (ISA), Smart 16/4 EISA Ringnode, and Smart 16/4 MCA Ringnode. The AT card has a 16-bit interface; the other cards have 32-bit interfaces.

All three boards used the same Texas Instruments Token-Ring controller (TMP380C16) and contained 128K of buffer memory. But the EISA Ringnode's memory consisted of dual-ported DRAM, while the memory in the AT and MCA Ringnodes consisted

of single-ported DRAM. The Madge Networks' *NetWare* driver, Version 1.5, was the same in all three cases, and the different memory architectures had no effect on our tests.

We loaded Novell's *NetWare* 386, Version 3.10, onto each test system, then created a 5MB DOS partition (for MS-DOS 4.01) and a 334MB *NetWare* partition—which was divided into a system volume of 50MB and a data volume of 284MB.

The load for the network tests consisted of 32 Compaq Deskpro 386Ns. Each 16-MHz 386SX system contained 5MB RAM, a 40MB hard disk, VGA video, and a 16-bit Proteon 1347 Token-Ring controller. The workstations were hooked through four Startek 828AT MAUs (Multistation Access Units) and wired to the network interface in each of our three file servers.

We ran the tests twice: first with all workstations wired on one ring and linked to a single NIC in the server, then with two rings of 16 workstations, connected to two separate NICs in the file server. Our test results reflect both setups. We ran all the tests with the token ring running at 4 megabits per second.

OUR TESTS

In these PC LAN Labs benchmark tests, load stations put different types of traffic on the network, and we determine how much data gets through.

The tests are run while our Workstation Throughput Evaluation test is running. In this test, one network workstation reads from and writes to a 1MB file on the server.

The remaining workstations run each of three load tests on the network: the Network Speed Load, Hard Disk Access Load, and Directory Access Load tests. We run these tests on 1, 3, 7, 15, and 31 workstations in turn. With three load tests and five workload levels, we can determine single-station throughput as well as the total work performed on the network. For all three load tests, we report both the total time and the server's CPU utilization (as indicated by the *NetWare* console monitor). ■



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BENCHMARK TESTS: ISA VS. EISA VS. MCA

HOW TO READ THE CHARTS

Each graph tells two stories about the EISA, ISA, or MCA server being tested. The first factor, represented by the length of the bars, is data throughput—the amount of work the server accomplished in the time it took 2, 4, 8, 16, or 32 workstations to run PC LAN Labs' benchmark tests, Version 3.03. The second question is how hard the server's CPU had to work for those workstations to complete each test; the answer is indicated by the position of diamonds, rectangles, and triangles representing CPU utilization on ISA, EISA, and MCA servers.

On the load workstations, we ran the benchmark test suite—which comprises the Network Speed Load, Hard Disk Access Load, and Directory Access Load tests—while a separate workstation on the network performed the Workstation Throughput Evaluation test simultaneously. (These tests are described in the sidebar "How We Tested" on the previous page.) For each configuration, we ran each test twice—first with one and then with two network interface cards in each server. The results are reported separately.

The uniform bar lengths at almost every given workstation level show that the server's bus architecture has

virtually no effect on actual network throughput, no matter what network load test is being run, and no matter how many workstations are running the tests. With the technology PC Magazine Labs uses, it is impossible to saturate even the ISA bus and create a bottleneck that would slow the server down.

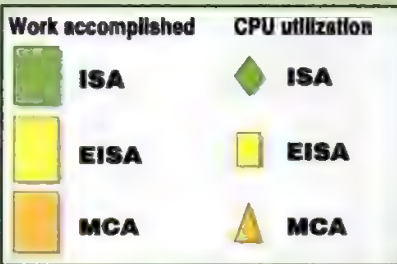
Differences in CPU utilization are more apparent, as the wide spacing of the bullets in each group indicates. In every case, the ISA CPU must work harder to process the same amount of information; in some cases, it actually runs at maximum capacity. By contrast, the bus-mastering EISA and MCA network interface cards and hard disk controllers relieve some of the pressure from those CPUs, as do EISA's and MCA's 32-bit bandwidths.

The **Workstation Throughput Evaluation** test measures the throughput of a single PC during the performance of a standardized task on the network (the Network Speed Load test, the Hard Disk Access Load test, or the Directory Access Load test). The test program performs a sequential read, a random read, a sequential write, and a random write using a 1MB file. The record size systematically rotates among 16K, 4K, and 512 bytes. The throughput is not reported here, but the duration of the test determines the length of time each load test runs.

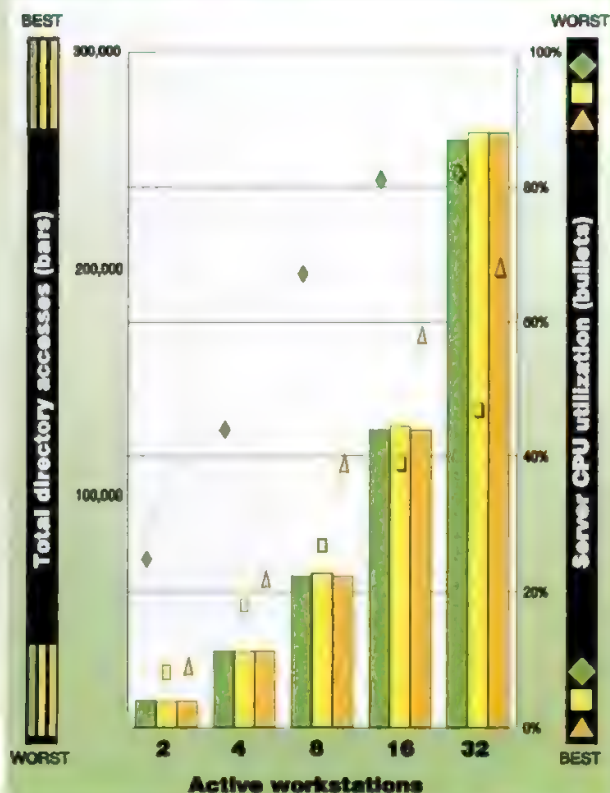
The **Directory Access Load** test makes the server repeatedly search for a nonexistent file. Since a network server's file allocation table is typically cached, this request causes a fast read to the cache. The repeated retries created by the client PCs generate a heavy load on the server's CPU. This test provides a method of loading the server's CPU in the fashion of a resident task, such as a network-monitor program or a communications program. The results for this test are reported as the total number of directory accesses for all the PCs running the load test.

The **Hard Disk Access Load** test reads random blocks of data in 1K increments from a 10K file on the server. The results for this test are reported as the total number of 10K reads for all the PCs running the load test.

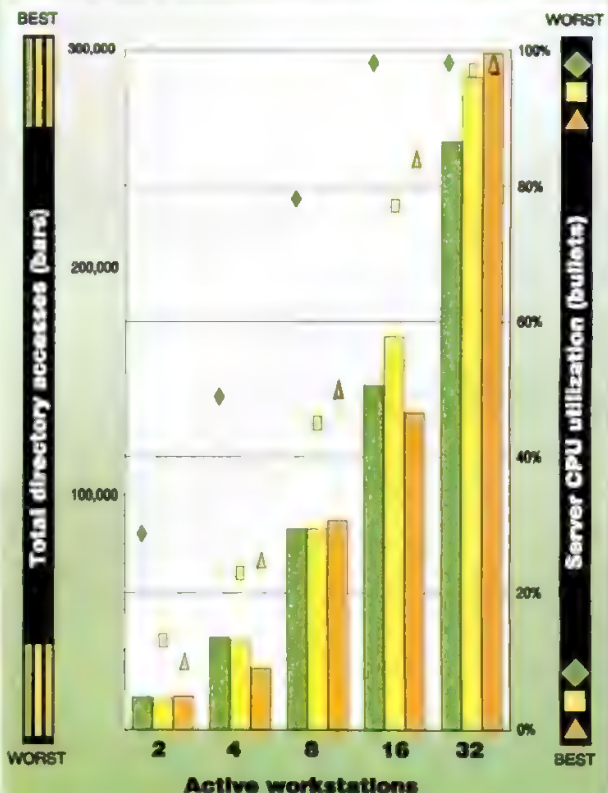
The **Network Speed Load** test requires each workstation to perform 1-byte reads from and writes to the server. Because the same byte of information is being accessed, it resides in NetWare's disk cache and therefore requires no hard disk access. This test gives an indication of network speed and server capacity. Its results are reported as the total number of 1-byte I/Os performed while the Workstation Throughput Evaluation test is running.



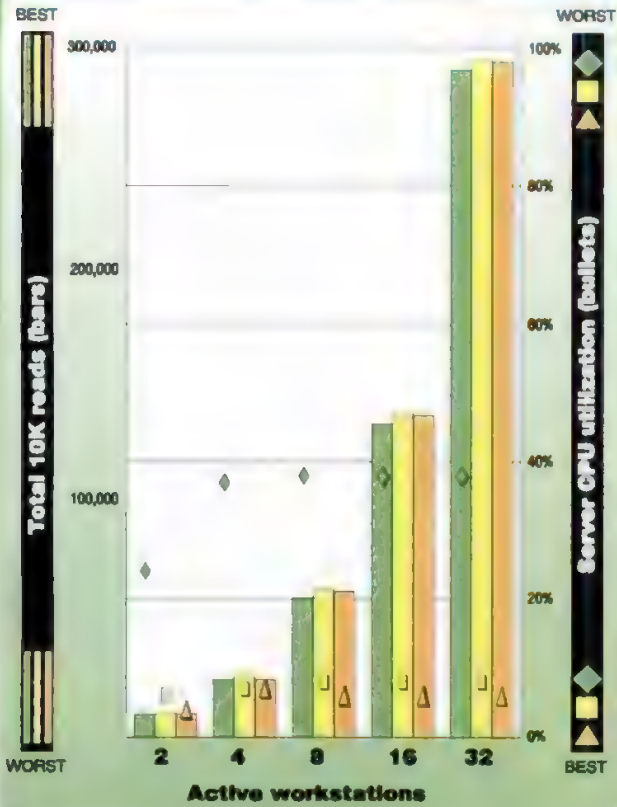
DIRECTORY ACCESS LOAD (One network interface card)



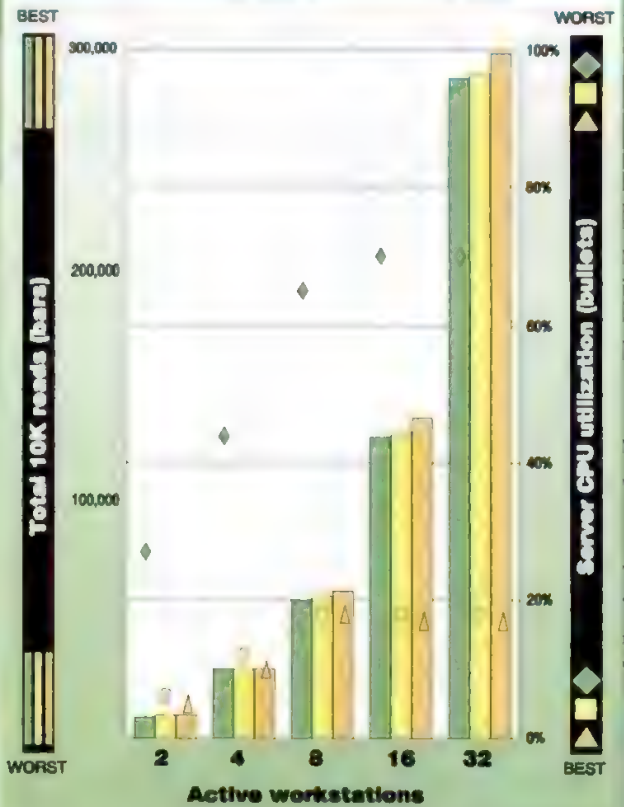
DIRECTORY ACCESS LOAD (Two network interface cards)



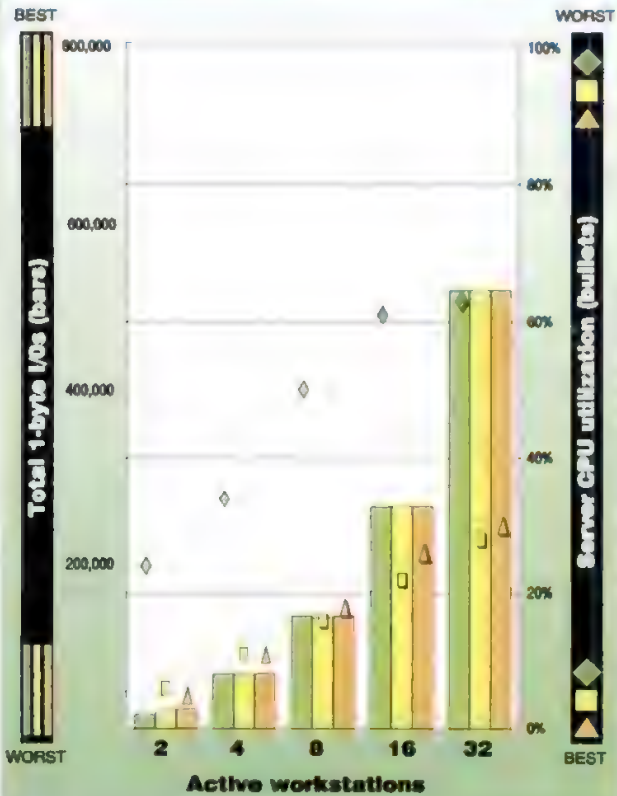
HARD DISK ACCESS LOAD (One network interface card)



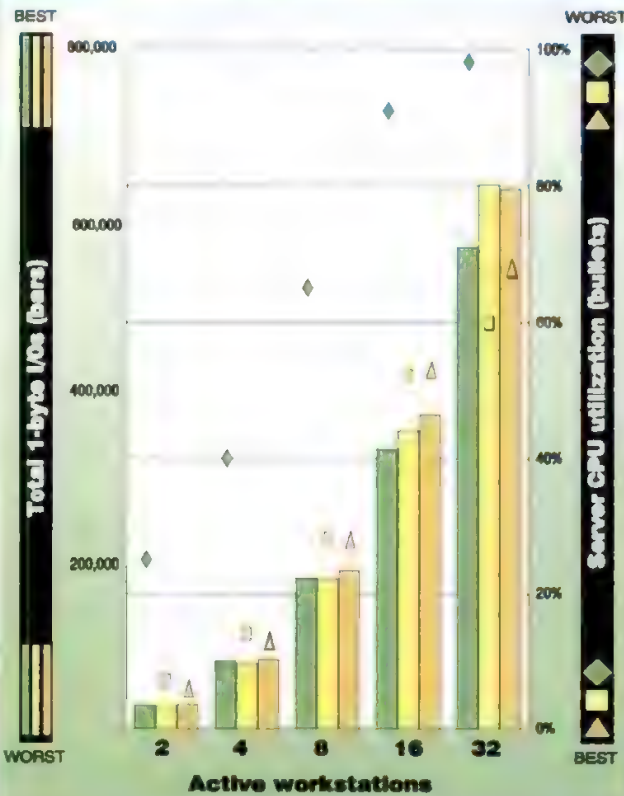
HARD DISK ACCESS LOAD (Two network interface cards)



NETWORK SPEED LOAD (One network interface card)



NETWORK SPEED LOAD (Two network interface cards)



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and then with ISA adapters. Our MCA system was the 33-MHz, 486-based IBM PS/2 Model 90. The systems were configured similarly, with 8MB of RAM, a 339MB SCSI hard disk, a bus-mastering SCSI hard disk controller from Bustek, and two bus-mastering network interface cards from The Madge Networks. The biggest difference between them was the external RAM cache, with 128K of 25-nanosecond cache in the ALR systems compared with 256K of 20-ns. cache in the Model 90.

Our tests show that ISA was clearly at a disadvantage as a network server—not for its throughput limitations so much as for the work it demands from the CPU. However, the tests don't show any important differences between MCA and EISA.

Differences in throughput among the three buses were minor, showing up only when the CPU on the ISA bus was loaded to capacity (32 active workstations on two network interface cards). The highest capacity we could manage with current technology—with 4MB per second for the SCSI drive and roughly 500K per second for each network card—barely hit the ceiling, even for the ISA bus.

On every test, the CPU in the ISA machine was working two to four times as hard as the CPU in the EISA or MCA machine. The EISA-based system scored a little better than the MCA in some cases and a little worse in others, but the two buses were generally similar in perfor-

mance. This measured difference between ISA on the one hand and EISA and MCA on the other is apparently due to a combination of two factors: bus width and bus mastering. Since the 32-bit bus width for MCA and EISA lets the system move twice as much data at a time as the 16-bit

You will hit 100 percent use of the CPU on an ISA system long before the EISA or MCA CPUs are breathing hard.

ISA bus, the CPU has to do only half as much work. In addition, bus mastering on the EISA and MCA buses takes even more work off the CPU.

As our results clearly demonstrate, when you add more work to a server, you will hit 100 percent use of the CPU on an ISA system long before the EISA or MCA is breathing hard. What's more, at any level below 100 percent, the extra work

for the CPU in the ISA machine means that there is less processing power left over for other tasks. If you're running programs from the server, for example, you'll notice a difference in how well they perform. On the other hand, our tests show no important differences between EISA and MCA.

Since we remained convinced that there was no significant performance advantage to any of the buses in a standalone or network-workstation environment, we did not repeat our standard suite of benchmark tests. Last year we ran those tests to evaluate processor, memory, disk, and video performance using 25-MHz, 486-based ISA, EISA, and MCA systems. As with this year's tests, we used the same system for both ISA and EISA test-beds—the ALR PowerCache 33/4e; however, last year we chose the ALR PowerCache 4 as our MCA system, since IBM did not offer a comparable 486. With few exceptions, the test results were nearly indistinguishable from one bus to the next.

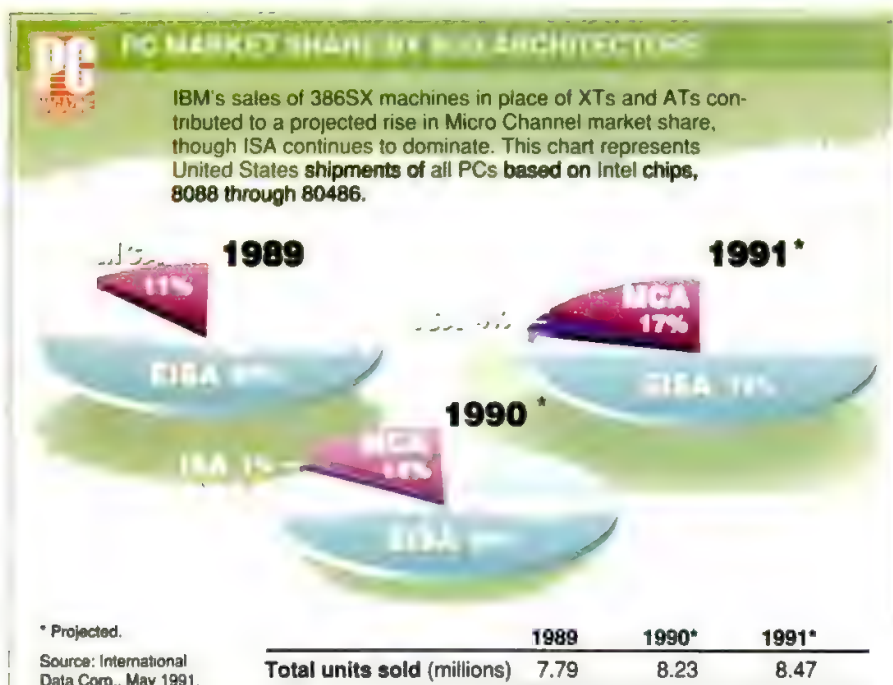
THE RIGHT BUS FOR CAD

Our results on standalone systems do not mean that advanced buses offer no performance benefit at all for standalone systems. In fact, there are some applications, such as high-end computer-aided design (CAD), where the bus can make a difference.

When you're manipulating high-resolution graphics in even mainstream applications like *Corel Draw* or *Photo Styler*, you're blasting lots of data over the system bus. Bump the resolution up to 1,280 by 1,024, add such features as 3-D graphics manipulation and 24-bit color for a true color image (as Alias Research's new program, *Upfront for Windows*, can do) and you're likely to saturate the ISA bus.

Matrox Electronic Systems in Dorval, Quebec, designs and manufactures graphics boards for scientific and engineering workstations, as well as for PC-based workstations, high-end desktop publishing, and the like. In particular, the company manufactures a 32-bit, 3-D graphics board (without bus-mastering capability) for the EISA bus.

Matrox claims that its 1,280 by 1,024 board gives the 3-D performance of a Sun workstation. But Raymond Snow, Matrox's PC CAD product line manager, says that to get that level of performance at this resolution and with 24-bit color, the company had to go with an advanced bus (it chose EISA). To achieve the same





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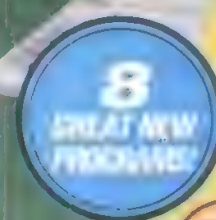


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(Niles & Associates) EndNote stores up to 32,000 references and creates bibliographies in any style you choose. A WordPerfect Hot-Key allows you to access your references while you write. Supports full search capabilities, adding and editing. Citations and reference lists are formatted and printed automatically in WordPerfect and MS Word (through RTF). In a few seconds, your bibliography is complete. **BS3444 \$115.**

CheckIt! 3.0

(TouchStone) CheckIt! is an information and diagnostic utility for PC owners. It gives you a complete readout of your system's configuration and runs a thorough series of diagnostics, testing the main system board, up to 16 MB of RAM, all kinds of disk drives, communication ports, printers and input devices. CheckIt! will even help repair or isolate any problems it may find. **UT0734 \$85.**



ACT! 2.0

(Contact) ACT!, the best-selling contact manager, is a powerful yet easy to use PC-based program that provides the database, scheduling and word processing functions most needed to organize the day-to-day activity of business people. ACT! is now available in Single-User **BS1064 \$215**, Network Server Plus One **BS3504 \$355** and 5-User network versions **BS3514 \$799**.

Pocket-Edition 2400

(Hayes) This laptop communications system comes complete with everything you need to go on-line today: 2400/1200/300 bps modem, communications software, telephone and computer cables and carrying case. Perfect for use with laptops or portables, Pocket Edition 2400 is lightweight and needs no batteries—it's everything you need to communicate using your laptop. **MM0810 \$125.**



FoxPro 2.0

(Fox Software) FoxPro 2.0 is the relational database management system that gives you the ease-of-use of a Graphic User Interface. dBASE applications run without change and custom applications have screen and menu builders that automatically generate their own code. New features include new memory management, smaller and faster compound indexes, automatic project management and an API with open architecture for C and Assembly programming. **BS4085 \$499.**



Unmouse

(MicroTouch Systems, Inc.) Use the most intuitive pointing device ever designed—your own finger. Introducing the Unmouse by MicroTouch. One million touch points and a touch sensitive glass tablet respond instantly to your touch. Unique templates allow you to execute function keys directly from the tablet. Also featuring truly outstanding graphics capabilities. **IN0810 \$189.**

ArtRight

★ Image Portfolio (various) 85.

Atech

GR2763/5 ★ Pub. Powerpak for Windows 55

GR2773/5 Pub. Powerpak for WordPerfect 55.

Berkeley Systems

GR1994 ★ After Dark 29.

Broderbund

GR1564 New Printshop 35.

GR0064 New Printshop Companion 29.

Caere Corporation

GR1984 ★ Omnipage 386 3.0 479.

Calera

GR2114 WordScan+ 669.

Computer Associates Int'l

GR1823 ★ CA Cricket Graph 1.3 85.

Corel Systems

GR0543/5 ★ CorelDRAW! 2.0 369.

Custom Applications

GR1945 Freedom of Press Light 2.5 55.

hDC Computer Corp.

BS3114 ★ Icon Designer 35.

Icom Simulations

GR1854 ★ Intermession 32.

Micrografix

GR1773/5 ★ Charisma 2.1 344.

GR1293/5 ★ Designer 3.02 469.

Microsoft

BS2304 ★ Powerpoint for Windows 315.

New Visions Technology

GR0823/5 ★ Presentation Task Force 134.

Power Up Software

GR0884 Express Publisher 2.0 99.

Software Publishing

GR0083/5 Harvard Graphics 2.3 319.

Timeworks

GR2334 Publish-It! 2.0 135.

Umage Corp.

GR2193/5 Perceive Personal 1.1 145.

GR2183/5 Perceive 389.

WordPerfect

GR1194 DrawPerfect 1.1 269.

Xerox

GR1574 ★ Ventura Pub. Gold 3.0 (Win.) 559.

ZSoft

GR0634 PC Paintbrush IV Plus 119.

GR2024 ★ Publisher's Paintbrush 2.0 299.

CAD PRODUCTS

American Small Business Co.

CA0023/5 Design CAD 3D 3.1 199.

CA0203 Design CAD 5.0 249.

AutoDesk

CA0173/5 Autosketch 3.0 146.

Computer Easy

CA0153/5 Dream House Professional 47.

Foresight Resources

CA0124 ★ DrafCAD for Windows 3.0 435.

Generic Software

CA0074 Generic CADD 5.0 285.

MathSoft

CA0193/5 MathCAD 3.0 319.

BUSINESS

Abacus

UT1684 ★ Becker Tools 2.0 76.

AddStar

UT2194 SuperStar 79.

Alpha Software

BS2164 Alpha Four 309.

Artworx

BS4093/5 Graftek 85.

Ashton Tate

BS0773/5 dBASE IV 1.1 485.

AutoMap, Inc.

BS4163/5 AutoMap 59.

Avery

GR0804 Label Pro Laser 45.

Borland International

BS0214 Paradox 3.5 505.

BS3044 Quattro Pro 3.0 319.

Brown-Wagh

FN0424 ★ Service Industry Accounting 295.

Buttonware

BS5134 PC File 6.0 85.

Campbell Services, Inc.

BS3584 ★ OnTime for Windows 75.

Career Design Software

BS4034 Career Design 65.

Central Point Software

UT2064 Central Point Anti-Virus 79.

UT2133 PC Tools 7.0 109.

Chronologic Corp.

UT0584 Instant Recall 62.

Computer Easy International, Inc.

UT2053/5 Command Performance 39.

Contact Software Int'l

BS1064 ACT! 2.0 215.

BS3514 5-User Network Version 799.

BS3504 Network Server Plus One 355.

DacEasy Inc.

FN0014 Dac Easy Accounting 4.1 85.

FN0024 Dac Easy Bonus Pak 4.1 129.

Darlene Technology

UT1894 System Sleuth Analyzer 45.

UT1904 System Sleuth Pro 3.0 63.

UT1704 ★ Win Sleuth 1.0 85.

Datastorm Tech.

CM0424 Procomm Plus 2.0 65.

DCA/Crosstalk Communications

CM0193/5 ★ Crosstalk for Windows 1.1 129.

Davidson & Associates

EN0024 Monologue 99.

Delrina Technology

BS0853/5 PerFORM Designer & Filler 2.1 95.

BS2604 ★ PerFORM PRO 149.

FX0154 WinFax Pro 2.0 75.

Enable Software

BS1803/5 Enable BP 129.

FastTrax International

UT2024 FastTrax 4.0 49.

Fisher Idea Systems

BS3543/5 Idealisher 3.1 399.

BS3574 Strategic Planning Plug-In Module 65.

Fifth Generation

UT0724 Direct Access 5.1 62.

UT0124 Fastback Plus 2.10 115.

Fox Software

BS0705 Foxbase + Dev. System 2.10 189.

BS4085 FoxPro 2.0 499.

Funk Software

BS3944 Sideways 3.3 w/ P.D. Queue 79.

GeoWorks

OP0064 GeoWorks Ensemble 125.

Gibson Research

UT0874 Spinrite II 2.0 59.

Great American Software

FN0264 Money Matters 51.

FN0215 One-Write Plus Acct. System 170.

hDC Computer Corp.

UT1944 ★ FileApps 69.

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NEW!

AutoMap (AutoMap Inc.) Before you head down the road, check with AutoMap, the colorful, computerized road atlas for PCs, with map displays and trip instructions. Just tell AutoMap where you're going and it will plan out your route for you. **BS4163/5 \$59.**



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SuperStor (AddStor) Increase your disk space with the fastest, most advanced PC Data Compression. Easy to install and use, no artificial DOS commands, compression of floppies and external media, database and transparent. DOS 5 compatible. **UT2194 \$79.**



Double Disk (Vertisoft) Double the capacity of your hard disk. Double Disk is a unique utility that eliminates the need to purchase a larger hard disk by using software only. **UT0904 \$62.**



ProModem 24/96BSR (Prometheus) 2400 bps data modem with 9600 bps send/receive fax. Supports 4.42bis/MNP-5 data compression and error correction. Software package includes Windows fax software. **MM0610 \$218.**



Publisher's Powerpak for WordPerfect

(Atech) Publisher's PowerPak works within WordPerfect to give great-looking output on over 400 printers including dot-matrix, inkjet or laser printers. It scales fonts from 6 to 1,000 pt. on-the-fly to the printer, eliminating the need for additional hardware or memory requirements. Includes 30 typefaces from three families of type and a FREE Super Font Pack, featuring 84 typefaces. **GR2773/5 \$55.**

UT1634	★ FirstApps	49
UT0644	★ Windows Express 3.0	49
Helix		
BS3154	★ NetRoom Single User 2.0	49
BS3134	★ NetRoom 4 User	91
Hewlett Packard		
BS2783/5	★ New Wave 3.0 for Windows	109
Informix		
BS2283/5	★ Wingz for Windows and OS/2	325
Insight Resource		
BS3423/5	Ko-Pilot for Lotus 1-2-3	59
BS3413/5	Ko-Pilot for WordPerfect 5.1	59
BS3433/5	Ko-Pilot for WordPerfect 5.0	59
Inner Media, Inc.		
UT1754	★ Wide Angle	65
Inset Systems		
UT1614	Hijaak 2.0	99
Intuit		
FN0164	Quicken 4.0	37
FN0434	QuickPay	30

WP0043/5	Word 5.5	209
WP0374	★ Word for Windows 1.1	305
BS0173/5	Works 2.0	95
Microsoft/Helix		
BN0043/5	DOS 5.0/Netroom Bundle	99
MultiSoft		
UT0554	PC-Kwik Powerpack 2.0	70
Niles & Associates		
BS3444	EndNote	115
Nolo Press		
BS0124	Willmaker 4.0	36
Norton-Lambert		
CM0143/5	Close-Up Customer/Terminal 3.0	129
CM0434	Close-Up LAN	550
CM0153/5	Close-Up Support/ACS 3.0	159
Numbers & Co.		
UT2125	Whiskers 3.01	19
Okna Corporation		
BS3124	★ Desk Top Set	85

★Netroom

(Helix Software) Now the award winning memory manager is even better. Netroom includes complete memory management, "hot key" help, information screens providing details on DOS, an integrated text editor and 8088/8086/80286 support. Netroom provides fully automated installation and can regain large amounts of extra memory while improving system performance. **BS3154 \$49.** Also available in 4-User **BS3134 \$91.** **Special Offer!** DOS5/Netroom Bundle only **\$99 BN0043/5.**



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BS2923/5	WillPower	32
Lotus		
BS3174	Agenda 2.0	288
GR0864	Ami Pro 1.2	299
BS4073/5	Lotus 1-2-3 Rel. 2.3	339
BS2654	Lotus Works 1.0	95
BS2433/5	★ Lotus 1-2-3 Rel. 3.1	405
BS2323/5	Symphony 2.2	515
Magee		
UT0844	AutoMenu 4.7	38
mBAilen		
BS5164	The Daily Plan-It!	65
Meca		
FN0243/5	Managing Your Money 7.0	135
Merrill & Bryan Enterprises		
UT0994	InfoSpotter 2.5	49
UT2034	Remote Rx	69
UT1654	★ Turbo FMS 6.0	56
Metz Software		
UT1804	ThreadZ File F/X	75
Microcom		
CM0084	Carbon Copy Plus 6.0	115
UT0894	Virex PC	78
Micro Logic		
BS5124	InfoSelect 2.0	89
Microrim		
BS3493/5	Personal R Base	99
Microsoft		
OP0113/5	DOS 5.0 Upgrade	59
BS3254	★ Excel for Windows 3.0	299
BS4103/5	★ Office for Windows 2.0	485
BS2733/5	★ Productivity Pack	39
BS2704	★ Project for Windows 1.0	445
BS2253/5	★ Windows 3.0	90
BS1954	★ Windows Developer's Tool Kit	315

Peachtree Software

FN0233/5	Peachtree Complete III 5.0	145
FN0253/5	Peachtree Cmpl III Bonus Bdl	215
Polaris		
BS2894	★ PackRat 3.0	259
BS2934	PackRat 3.0 Network Pack	429
Precision Software		
BS1874	★ Superbase 4 Windows	410
Prisma Software		
UT1044	★ Your Way	129
Que Software		
WP0554	★ Legacy	298
QMS		
BS1624	★ Ultrascript PC Plus 2.1	279
Qualitas		
UT0683/5	386Max Professional 5.1	75
UT1673	BlueMax	89
Quarterdeck Office System		
BS0163/5	DESQview 2.3	79
BS1043/5	DESQview 386 2.3	135
EX1103/5	★ OEMM 386 5.1	61

Pro AudioSpectrum

(Media Vision) Pro AudioSpectrum is an affordable PC audio adapter that brings audio capabilities to both DOS and Windows based PC's. Features include on board analog mixing, MIDI support and CD-ROM drive interface, stereo PCM digital sampling. Level 1 compliance with multimedia extensions to windows and more. Supports applications that are AdLib and Sound Blaster compatible. **EX1580 \$259.**

Que Software

WP0544	RightWriter 4.0	55
Reality Technologies		
FN0124	Wealthbuilder 1.1	139
FN0334	WealthStarter 1.0	35
Reference Software		
WP0334	Grammatik IV 2.0	55
WP0514	★ Grammatik Windows	55

Sea, Inc.

UT2114	Arc-Plus 7.12	49
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Server Technologies, Inc.

CM0454	Power On/Off	199
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SitBack Technologies

BS3554	★ SitBack for Windows	79
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Softlogic Solutions

UT0073/5	Disk Optim Tools w/ Data Guard	35
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Software Directions

UT1914	★ Print Q 5.0	85
UT0884	PrintQ LAN	285

Software Products International

BS2864	★ Access SQL Multi User	949
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BS2873/5	Open Access III	425
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Software Publishing

WP0463/5	Professional Write 2.2	160
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WP1523/5	★ Professional Write Plus	169
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Software Ventures Corp.

CM0314	★ MicroPhone II for Windows	215
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Spinnaker Software

BS1923/5	BetterWorking Eight-In-One	32
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BS1134	The Resume Kit	29
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Symantec

WP1573/5	★ Just Write	75
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UT2154	Norton AntiVirus 1.5	85
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UT0054	Norton Util. Advanced 6.0	115
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LT2153	★ Norton Backup Windows/DOS	85
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BS0653	Q&A 4.0	235
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BS3723/5	On Target 1.0	255
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Symantec/Helix

BN0024	Norton Util. w/ Netroom Bundle	134
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Teleware

FN0414	★ M.Y.O.B.	135
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Timeslips Corp.

BS0133/5	Timeslips III 4.0	189
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Touchstone

UT0734	Check It! 3.0	85
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Traveling Software

UT0394	Laplink III	89
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UT2014	★ WinConnect 1.0	65
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Trend Micro Devices

UT1964	PC-Citlin Virus Immune System	99
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Vertisoft

UT0904	Double Disk	62
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WestCliff Software

WP1504	DosAmigos	99
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WordPerfect Corp.

WP0363/5	WordPerfect 5.1	249
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WP0504	LetterPerfect 1.0	129
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WordScience

WP0483/5	Definitions Plus	65
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WordStar U.S.A.

WP1604	★ Correct Grammar for Windows	59
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WP0634	WordStar Legacy	269
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XTree Company

UT1874	XTree Gold 2.0	92
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LANGUAGES

Asymetrix

..N1454	★ Toolbook	289
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Borland International

..N1654	Borland C++ 2.0 Prof.	335
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..N1664	★ Object Vision for Windows	95
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Microsoft

..N0074	C Compiler 6.0	315
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..N0043/5	QuickC 2.5	65
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..N1674	Visual Basic	129
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Nantucket

LN1444	Clipper 5.1	510
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Solution Systems

LN0433/5	Brief 3.1 for DOS	179
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Spinnaker Software

LN1464	★ Spinnaker Plus	269
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performance from a comparable ISA card, the company had to limit the board to 12-bit color.

With half the number of bits per pixel, the ISA version of the board moves about half the data across the bus. But the board also has far fewer colors to work with on screen—4,096 rather than 16.7 million.

Our network server tests show that multimedia or multitasking can overwhelm an ISA-based system.

That's the difference between photographic-quality true color and cartoon-quality color.

Marginally closer to the mainstream (though still a \$6,000 option) is Matrox's Impression board, an 1,152 by 882 resolution, 24-bit color, ISA board for high-end desktop publishing applications. If you put the ISA Impression board in an EISA system, certain aspects of *Windows* applications will run faster, according to Adam Walters, product line manager for desktop publishing products at Matrox, because the ISA bus can be a bottleneck for *Windows* with 24-bit color.

Even so, Walters says, only those tasks that involve reading from or writing to disk will improve under the EISA bus: for example, opening new program windows, swapping information between memory and disk in 386 Enhanced mode, or reading from overlay files in such large programs as Aldus's *PageMaker 4.0*. Walters also insists that *Windows* has plenty of room for performance improvement. And if Microsoft introduces a full 32-bit implementation or tweaks the current version of the program, the CPU may wind up sending data to the card faster than the ISA bus can handle it. At that point, moving to an EISA card would certainly make sense.

AND FOR THE MAINSTREAM...

The obvious lesson from our network server tests and these high-end single-user applications is that an ISA-based

system can, indeed, be overwhelmed—a possibility with multimedia, for example, or multitasking.

Consider some numbers: A 16-mega-bit token-ring or Ethernet card yields a maximum throughput of 2MB per second, which is well within the capabilities of an ISA bus. A high-performance SCSI interface offers users a maximum throughput of 4MB per second, still within the ISA bus capacity, but beginning to saturate it.

Add these two cards to your system,

along with a multitasking environment that can use both at once, and even mainstream apps may begin to overwhelm the bus. Add a 1,024-by-768 graphics card, a graphical user interface (GUI) environment and applications, and that likelihood quickly multiplies.

Multimedia offers users still more possibilities. Consider, for example, rich e-mail (with voice messages that are attached as notes to text documents), or full-motion 24-bit color images that can be used for education and training. Applications like these will blast many megabytes of data over the system bus—almost cer-

MICRO CHANNEL II: Faster Throughput on the Horizon

by M. David Stone

How much throughput is enough? For today's network applications, MCA's basic data transfer mode of 20 megabytes per second or EISA's 33 MBps is all you need. Even with ISA's 4-MBps maximum, you'll probably have all the throughput you need for everyday desktop use.

Nevertheless, a few Micro Channel adapters, all related to communications or connectivity, use a special 40-MBps mode specified in IBM's so-called Micro Channel II. Throughputs of 80 MBps and even 160 MBps have been promised.

IBM introduced the MCA bus on the PS/2 in 1987. The EISA standard was announced in September 1988. One year later, as EISA systems were becoming real products, IBM released what it called additional information on Micro Channel architecture. Its September 1989 announcement described three additional data-transfer modes: The first raises the maximum throughput for MCA to 40 MBps, exceeding EISA's 33-MBps spec. The second raises it to 80 MBps. The third, care-

fully hedged as a potential future capability, raises it to 160 MBps.

IBM's description of these faster modes is often referred to as Micro Channel II, though you can take advantage of the



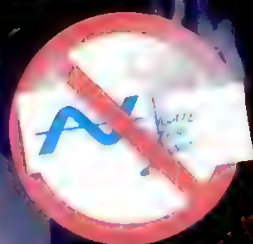
faster throughputs even with the earliest MCA systems.

The capability for each MCA mode is built into individual adapters and other system elements. When data moves between any two components—system memory

and adapter, system processor and adapter, or adapter and adapter—the system automatically determines the fastest mode available in both components.

In other words, two adapters designed for 40-MBps throughput can transfer data between them at that speed even if the system memory and system processor are designed for 20 MBps. No PS/2 system yet available can accommodate such high speeds between an adapter card and processor or an adapter card and motherboard system memory. However, IBM says that in the future, Models 90 and 95 will allow an upgrade to the faster modes. ■

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FACT: Computer Shopper compared 3 systems in its July cover feature. **TOUCHE** beat NORTHGATE and DELL in the overall total speed test for performance! Shopper also said, "**TOUCHE**'s system operated quietest. . . **TOUCHE** obviously offers the fullest expansion of the three systems. . . **TOUCHE**'s ESDI edged out NORTHGATE's IDE drive and DELL's slower IDE" Of all three systems **TOUCHE** was the least expensive. Shopper also said, "In fit and finish **TOUCHE** offers among the best we've seen."

FACT: Our AMI partnership enabled us to begin shipping 386 to 486 upgradable systems in 1989. . . 2 years before NORTHGATE even announced theirs! Northgate President Art Lazere is quoted in PC WEEK 06/03/91, "Upgradable is the wave of the future. . ." Unfortunately anyone riding the NORTHGATE wave is sunk when it comes to upgrading their 386 systems. Now that everyone wants a 486 anyway, what good is that to customers that bought Northgate systems for the past 2 years? Only GATEWAY knows when their upgradable system will ever become available.

FACT: **TOUCHE** was first to offer a 386 caching motherboard because AMI was the first to design a caching 386 motherboard.

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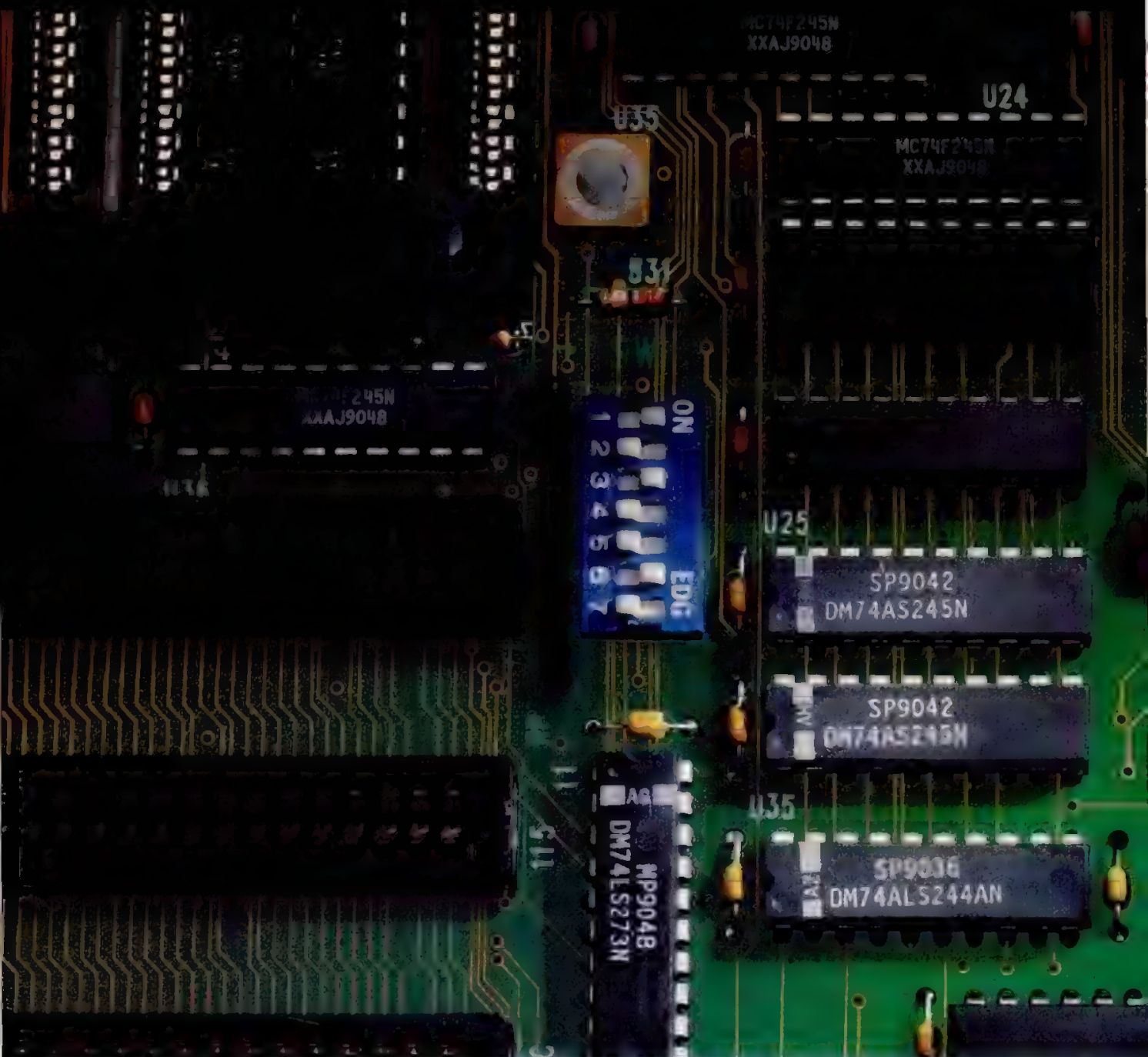
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tainly enough to benefit from moving to MCA or EISA.

IBM offers a more conservative vision of the immediate future, but one that's almost a blueprint for how to overwhelm the ISA bus. IBM sees an increasing reliance on multitasking GUI environments, with communications going on in background. The GUI windowing environment itself will put its own demands on the bus, with plenty of graphics data to move around. And as users begin linking applications—spreadsheets and databases, for example—a change in one data file will put more demands on the system as it updates linked files.

IBM also expects a gradual move to 32-bit software, spurred, in part, by IBM's own 32-bit OS/2, Version 2.0. As already pointed out, the performance increase at the CPU from 32-bit software could shift the bottleneck in some applications from the CPU to the ISA bus.

The conclusion seems inescapable. As today's leading-edge applications become solidly mainstream (possibly within the next two years), there will be a measurable performance benefit from moving to an advanced bus.

EISA VS. MCA

If you decide to go with one of the advanced buses, the issue then becomes which one to pick. If you treat the choice as a technical question, and the issue is

— ♦ —

**IBM sees an increasing
reliance on multitasking
GUI environments,
which will put
increased demands on
the bus.**

— ♦ —

EISA versus MCA. If you treat it as a marketing question, it comes out as EISA versus IBM.

Consider the technical side first: As should be clear, performance is a non-

issue, with our tests showing little difference between the two buses. MCA's 40MB- and 80MB-per-second throughput rates currently offer a higher ceiling for the MCA bus. But by the time any mainstream applications exist to take advantage of that kind of throughput, odds are that EISA, too, will have an EISA II.

Compaq, one of the key players in the EISA consortium, says there are no immediate plans for taking the EISA specification any further, but that people are "talking about talking." And Compaq insists that EISA will evolve with time.

Of course, there are other issues besides raw performance. But as often happens with competing technologies, the merits of the differences are a subject for debate. It can be more difficult to build sophisticated boards for MCA than for EISA, for instance, simply because of the restricted real estate. MCA cards, by definition, are small: Build a card that measures more than 33 square inches, and it won't fit inside an MCA chassis. EISA boards, by comparison, are 58 square inches.

Though there's something to be said for an MCA system's smaller footprint, MCA is clearly at a disadvantage—espe-

Why should you
have to pay for
a network
just to share
a printer?

COMPUTERS ISA, EISA, MCA

cially when some bus-mastered, caching, EISA disk controllers at PC Labs are so crowded with silicon that some of the chips have to go on the back of the board. And that's with space-saving, expensive, surface-mount technology, in which the leads on the chips are placed closer together than in standard DIP packaging.

Buying MCA will all but lock you into IBM. Not only does IBM have most of the MCA market, but it's also one of the few players in the game.

SOME OTHER PLAYERS

Among 25 top PC vendors, only five besides IBM offer MCA systems: NCR, Memorex-Telex, Wang (which now resells IBM computers), GRiD, and ALR. All but ALR have as their natural habitat the same large corporations that are likely to be nearly true-Blue shops. Add some lesser-known companies like Apricot and Reply, and you've virtually exhausted your options.

NCR is hitching its plans very tightly to the MCA bus despite its alliance with AT&T (an original member of the EISA consortium). All but NCR's low-end systems will continue to be MCA-based,

though the company will provide support for AT&T computer system customers it just inherited.

ALR, GRiD, and Memorex-Telex offer MCA and EISA. However, Memorex-

◆

**Buying MCA all but
locks you into IBM.
IBM dominates that
market and remains
one of few players
in that game.**

◆

Telex leans toward MCA, while GRiD leans towards EISA, keeping its toe in the MCA waters with a single 386/20 machine. ALR, best known in this group for its attention to price/performance, admits

that only 1 to 2 percent of the systems it currently sells are MCA-based (about 65 percent are EISA).

Most card manufacturers are choosing EISA as well. UltraStor, for example, offers several 32-bit EISA, bus-mastering, caching disk controllers, but none for MCA. Steve Roberts, President of UltraStor, says that the company could easily build an MCA card but just doesn't see a market for it. As Roberts points out, IBM isn't going to buy his card for IBM machines, since IBM makes most of its own controllers, and most MCA systems come directly from IBM.

In effect, the answer to the ISA, EISA, MCA question is: A place for everything and everything in its place. The place for ISA, for now, is in most standalone systems and network workstations. The place for EISA, for now, is in most network servers in offices that otherwise use the ISA bus. The place for MCA is the true-Blue office. And in the not-too-distant future, the place for EISA will be on those desks currently occupied by ISA. ■

M. David Stone is a contributing editor of PC Magazine.

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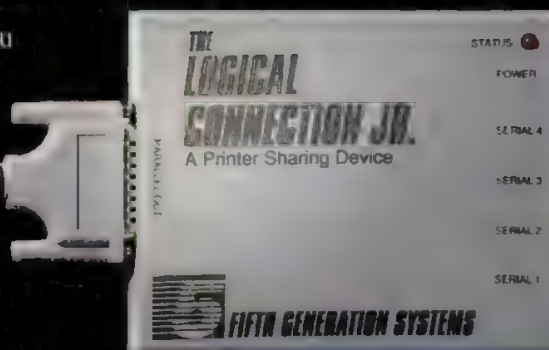
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OPTION
Tandon

CIRCLE 508 ON READER SERVICE CARD

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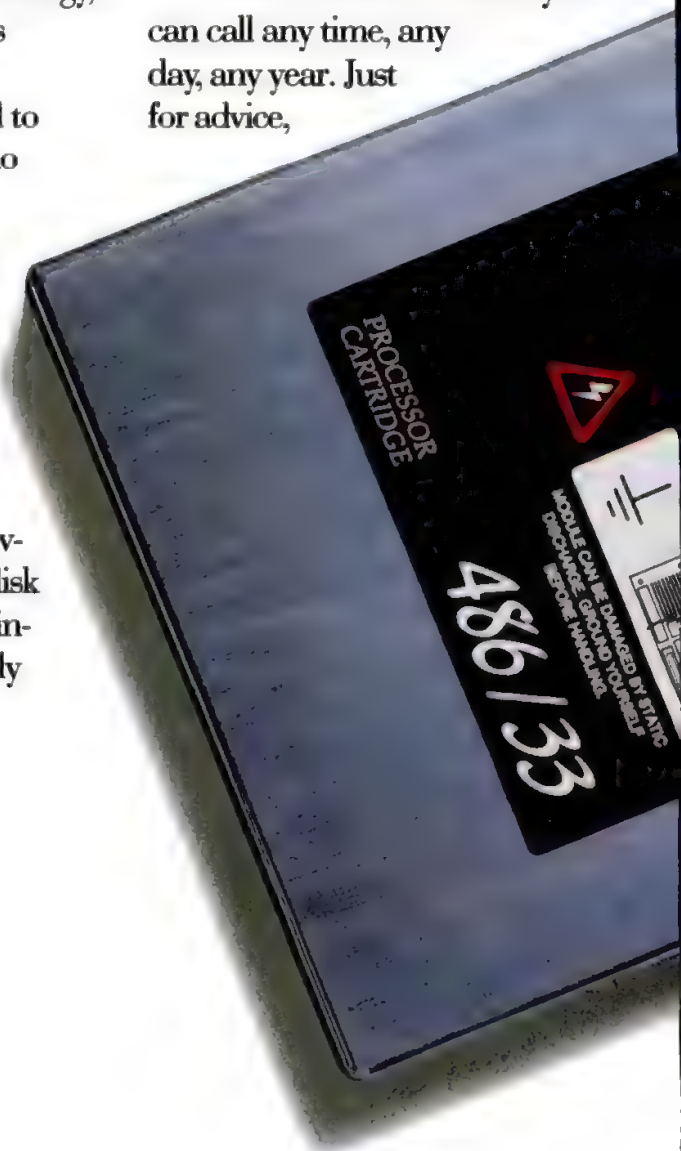
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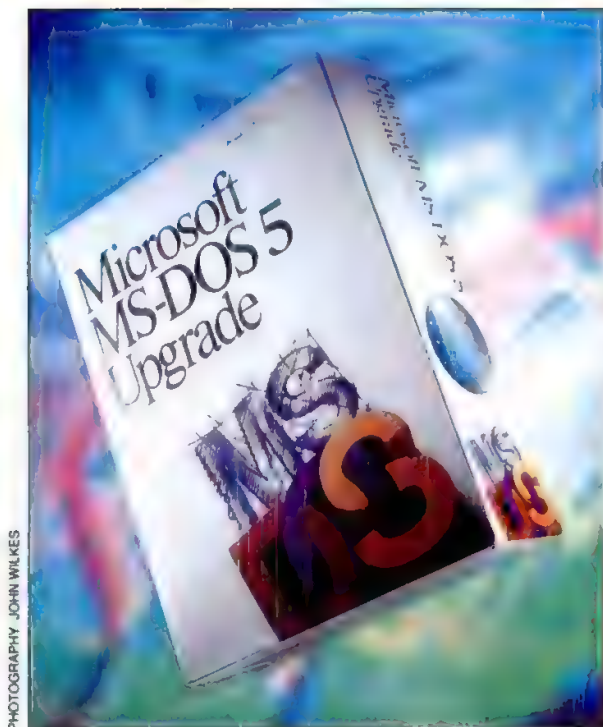
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CIRCLE 304 ON READER SERVICE CARD

DOS 5



PHOTOGRAPHY: JOHN WILKES

From fast formatting to memory management, from an undelete command to a user-friendly Shell, DOS 5.0 has the features you've been waiting for and a price tag that makes upgrading irresistible.

What's in It for You?

by Jeff Prosize

Cut through all the hype surrounding the release of MS-DOS 5.0 and the big question remains: What's in it for you? Is DOS 5.0 worth the cost of an upgrade when DOS 3.3 or 4.0 does everything you need? More importantly, if you're an IS manager looking at the cost of 100 or perhaps 1,000 upgrades, is the increase in productivity going to offset the cost of retrofitting all your PCs with DOS 5.0?

Here are some straight answers about DOS 5.0, and some hands-on advice on setting it up to get the maximum return on your investment. What's in it for you? Plenty.

UP AND RUNNING

DOS 5.0 is the most powerful release of DOS to date and is likely to be the most popular, too. Of the 60 million or so DOS users who exist, fewer than half made the upgrade from Version 3.3 to the memory-hungry Version 4.0.

The new version comes in two forms: as a standalone package for installing DOS on a PC for the first time, or as an upgrade kit for changing the DOS version already on a PC. (You don't have to show proof of purchase to buy the upgrade, but the kit has no bootable DOS disk. If you don't already own a copy of DOS, you can't install the upgrade.)

If you buy the upgrade kit, you'll find an automated installation program that replaces the current version of DOS on your hard disk with DOS 5.0. It even saves the old version of DOS on a floppy disk so that you can reinstall it if DOS 5.0 proves to be incompatible with your PC. Total time required for the upgrade is approximately 5 minutes. Contrast this with the old days, when installing a new version of DOS meant reformatting the hard disk, and the savings are substantial indeed.

The installation program isn't perfect, however. The biggest complaint from users is that it won't repartition hard disks to take advantage of DOS 5.0's support for larger-than-32MB partitions. Let's say you have a 60MB hard disk divided into two 30MB partitions with DOS 3.3 and you purchased the DOS 5.0 upgrade so you could configure the entire hard disk as a 60MB C: drive. Surprise! You have to back up your hard disk, install DOS 5.0 on a set of floppy disks, boot from the floppy disks, repartition the hard disk with the DOS 5.0 version of FDISK, install DOS 5.0 from the floppy disks, and finally restore the data backed up earlier. In other words, the installation program is absolutely useless to you. Considering the millions of users who are upgrading directly from DOS 3.3, we find it surprising that Microsoft didn't make this phase of the upgrade more automatic.

If your disk has been partitioned by an on-the-fly compression utility like *Speed-Stor* or a setup utility like *Disk Manager*, be sure to read the README.TXT file on Disk 3 (in 3.5-inch floppy disk format) or

Disk 5 (in 5.25-inch floppy disk format) to get specific instructions on how to

proceed with the upgrade. This vital file is loaded with hundreds of hints about switches and settings for every possible installation situation.

COMMAND PERFORMANCE: The Best of DOS 5.0

by Jeff Proise

Depending on how you count them, there are approximately 90 commands and drivers in DOS 5.0. Here's a quick look at the best ones along with some of the parameters and switches that make them so useful.

DIR

DIR has been around since DOS, Version 1.0, but it takes on some new characteristics in Version 5.0. Place a minus sign in front of these attributes or order parameters to reverse their effects on the listing.

Syntax:

```
DIR filespec [/A[:attr]] [/O[:order]]
```

Example:

```
DIR *.txt/O-S
(for a list of .TXT files in
descending order by file size)
```

/A:attr List files by attribute
 A Files whose archive bits are set
 D Directories
 H Hidden files
 R Read-only files
 S System files

/O:order Sort files by name, extension, date, or size
 N Sort by name
 E Sort by extension
 G Separate files and directories
 S Sort by size
 D Sort by date

/S Search descendant directories, too

DOSKEY

This command adds the DOS command-line features that should have been added years ago: command recall and editing, and support for command macros. Throw in the ability to enter more than one command per command line and you've got a tidy little package

that's hard to resist.

Syntax:

```
DOSKEY [macro=[command]] [/MACROS]
[/HISTORY]
```

macro Macro name
command Command to assign to the macro
/MACROS List all macros that are currently defined
/HISTORY Display command history

EDIT

Few will mourn the demise of EDLIN, especially now that DOS includes its own full-screen text editor. The Editor requires the presence of QBASIC, so don't erase QBASIC.EXE if you want full-screen editing. Another command to try out in DOS 5.0: ERASE EDLIN.EXE.

Syntax:

```
EDIT filename [/B] [/H]
```

Example:

```
EDIT sample.txt/H
```

/B Run in black and white (great for laptops)
/H Switch to the highest number of lines the video adapter will support

GRAPHICS

In DOS 4.0, GRAPHICS was finally upgraded for EGA and VGA video adapters. In DOS 5.0, it works with the Hewlett-Packard LaserJet Series, too.

Syntax:

```
GRAPHICS [printertype] [printerfile]
```

Example:

```
GRAPHICS laserjet
```

printertype Type of printer (LASERJET or LASERJETII if you own a LaserJet)
printerfile Name and location of the file that contains printer information (GRAPHICS.PRO)

One of the most exciting new features of DOS 5.0 is its ability to utilize the memory in your system better, particularly on 286-, 386-, and 486-based PCs.

HELP

Type **HELP** and the name of any DOS 5.0 command and you get on-line help. Better yet, run any command with a **/?** switch and you'll get the same help listing.

Syntax:

HELP command or command/?

Example:

HELP LOADHIGH

LOADHIGH

This command epitomizes what DOS 5.0 is all about. **LOADHIGH** loads TSRs above 640K on 386 and 486 PCs, which is out of the way of programs that run in conventional memory. Its counterpart, **DEVICEHIGH**, does the same for device drivers.

Syntax:

LOADHIGH filename

Example:

LOADHIGH net5.com

MEM

MEM wasn't bad when it was introduced in Version 4.0. It's even better now that it has a **/C** switch, which shows what is loaded in upper and lower memory and how much space each program consumes.

Syntax:

MEM [/C] [/D] [/P]

Example:

MEM/C

- /C** Show contents of upper and lower memory
- /D** List program and internal drivers loaded
- /P** List programs loaded

SMARTDRIVE

Not to be outdone by *Microsoft Windows*, DOS 5.0 ships with its own version of the **SMARTDrive** disk-caching utility. **SMARTDrive** will put spring in the step of even the slowest hard disk, and it's a pretty good way to put extra memory to use as well.

First, regardless of what type of PC it is installed on, DOS 5.0 consumes less

Syntax:

DEVICE [HIGH]=[driver] [MaxSize] [MinSize] [/A]

Example:

DEVICEHIGH=SMARTDRV.SYS

- MaxSize** Disk cache size in kilobytes
- MinSize** Minimum cache size in kilobytes
- /A** Place cache in expanded rather than extended memory

UNDELETE

Microsoft decided to borrow a page from *The Norton Utilities* (or *PC Tools*, to be more precise) and give you the ability to recover deleted files. Most of the time you can forget the switches and just type **UNDELETE**; DOS will do the rest.

Syntax:

UNDELETE [filename] [/LIST] [/ALL]

Example:

UNDELETE sample.txt

- /LIST** List files that can be undeleted
- /ALL** Undelete without prompting you for the first character in every filename

UNFORMAT

Sure, you don't format the wrong disk very often, but **UNFORMAT** does more than unformat disks: Combined with the **MIRROR** command, it also restores hard disk partition tables.

Syntax: To restore corrupted partition tables:

UNFORMAT /PARTN

To display partition table information:

UNFORMAT /PARTN /L

To unformat a formatted disk:

UNFORMAT d:

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CIRCLE 475 ON READER SERVICE CARD



BENCHMARK TESTS: DOS 5.0

Although the performance differences among these operating systems are slight, MS-DOS 5.0 emerges as the fastest DOS ever.

WHAT THE NUMBERS MEAN

These results show that MS-DOS performance has improved since Version 4.01, with Version 5.0 matching and even surpassing the earlier, leaner Version 3.3. MS-DOS 5.0 consistently outperformed Digital Research's DR DOS 5.0 in the fixed-size DOS File Access tests, losing to DR DOS only on the small-record DOS Variable-File-Size Access test.

In caching tests, Microsoft's SMART-

Drive beat DRCACHE (the caching software included with DR DOS), but that was not surprising since DRCACHE works only with disk reads. For large records, DRCACHE proved a hindrance to speed, and both caches were counterproductive on the DOS Disk Access test. Keep in mind, however, that disk caching is least effective on random disk reads.

HOW WE TESTED

We ran the tests on a 25-MHz Compaq Deskpro 386/25e with 8MB of extended RAM and a 300MB hard disk, which was divided into 33MB partitions. For software caching tests, a 2MB cache was set up in extended memory.

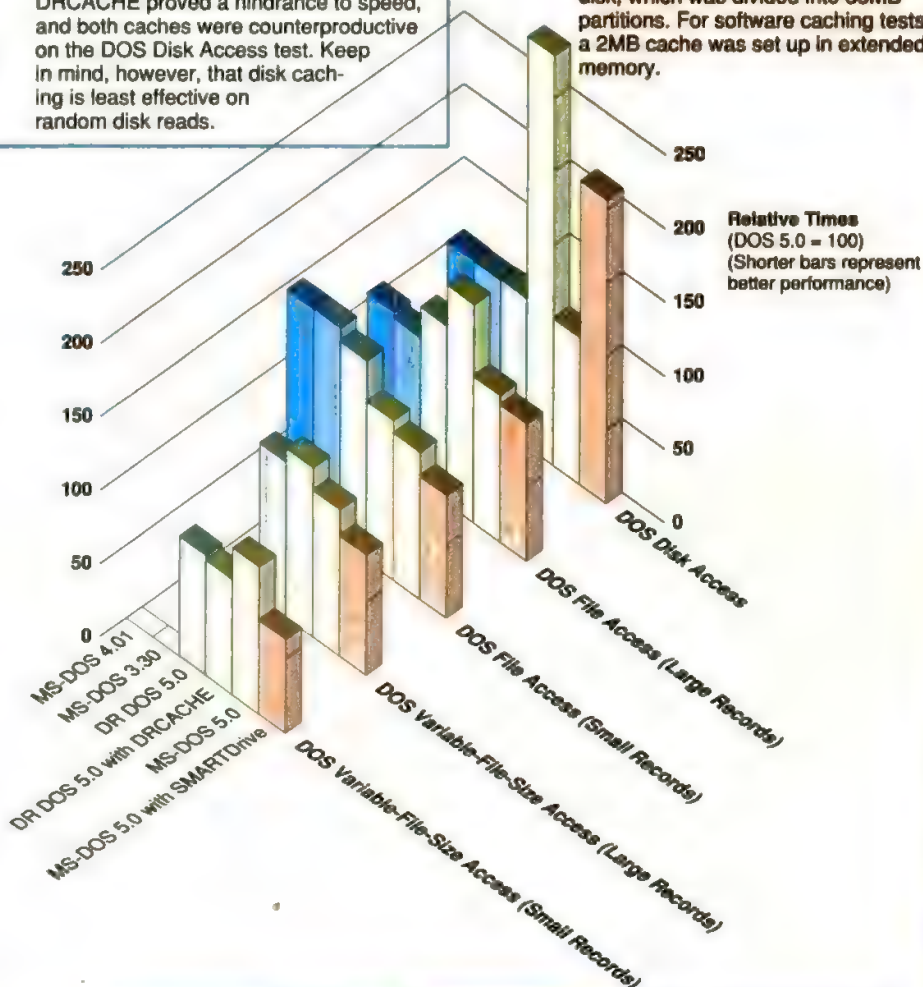
■ **The DOS Variable-File-Size Access (Small Records)** benchmark test is similar to the DOS File Access tests and was designed primarily for testing disk caches. File sizes ranged from 300 to 19,200 records each. DOS was loaded in extended memory.

■ **The DOS Variable-File-Size Access (Large Records)** benchmark test is similar to the DOS File Access tests and was designed primarily for testing disk caches. File sizes ranged from 30 to 1,920 records each. DOS was loaded in extended memory.

■ **The DOS File Access (Small Records)** benchmark test measures the differences in disk throughput as a result of operating-system overhead. The test reads from and writes to both random and sequential files containing small records (up to 4K). No software disk caching was used for MS-DOS 3.30 and 4.01. MS-DOS 5.0 and DR-DOS 5.0 were tested with and without cache.

■ **The DOS File Access (Large Records)** benchmark test measures the differences in disk throughput as a result of operating-system overhead. The test reads from and writes to both random and sequential files containing large records (up to 32K). No software disk caching was used for MS-DOS 3.30 and 4.01. MS-DOS 5.0 and DR-DOS 5.0 were tested with and without cache.

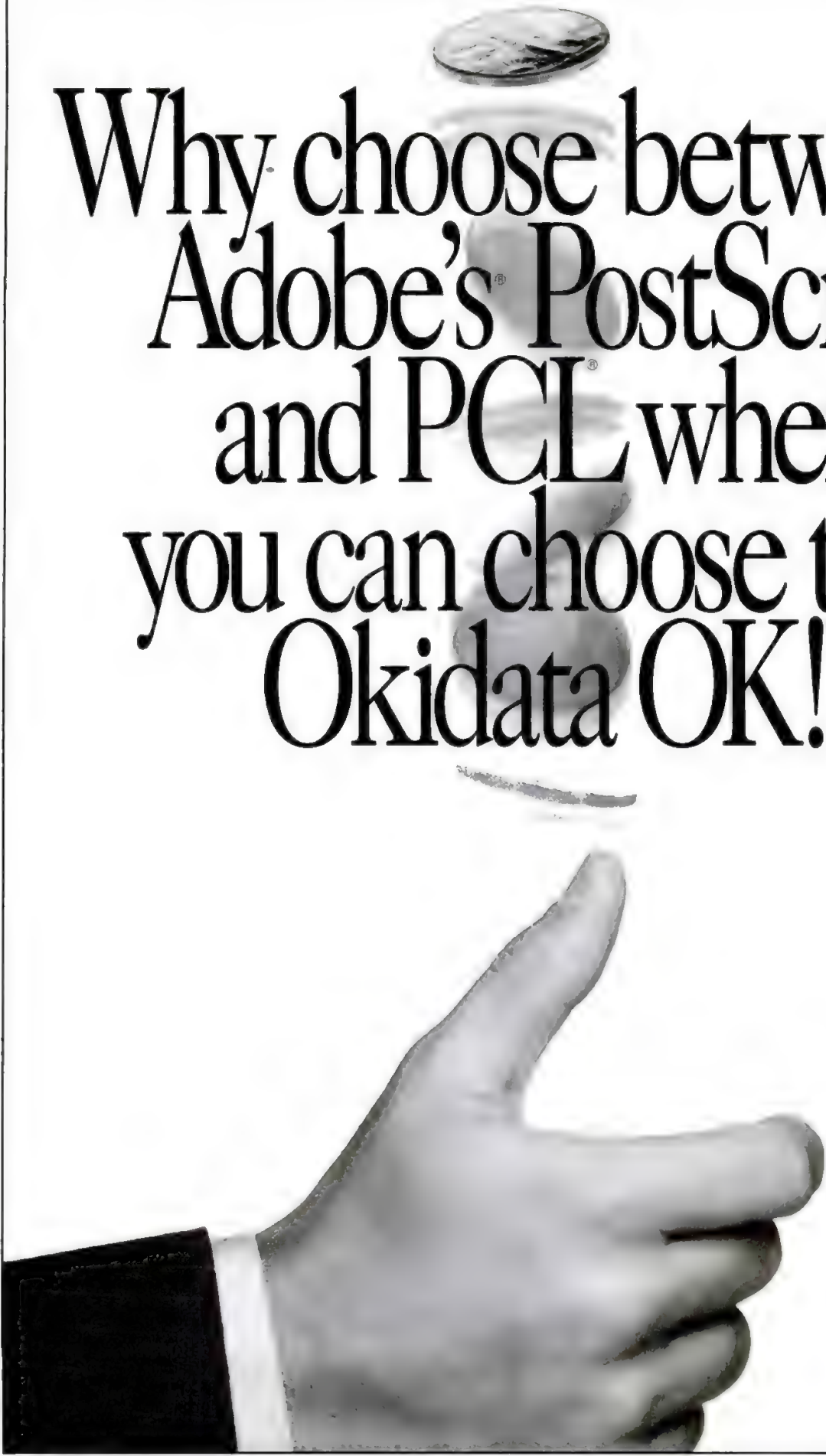
■ **The DOS Disk Access** benchmark test measures the time necessary to perform 1,000 DOS read requests at random locations on the disk. DOS was loaded in conventional memory, and the default configuration was used.



(Lower scores represent better performance)

	DOS Variable-File-Size Access (Small Records) (seconds)	DOS Variable-File-Size Access (Large Records) (seconds)	DOS File Access (Small Records) (seconds)	DOS File Access (Large Records) (seconds)	DOS Disk Access (milliseconds)
MS-DOS 4.01	N/A	N/A	51.88	3.89	16.15
MS-DOS 3.30	N/A	N/A	51.85	3.73	16.01
DR DOS 5.0	953.65	415.34	48.68	4.51	16.13
DR DOS 5.0 with DRCACHE	910.98	450.98	38.64	5.53	44.76
MS-DOS 5.0	1,163.08	391.24	35.67	3.73	16.02
MS-DOS 5.0 with SMARTDrive	737.66	322.21	29.84	3.48	33.07

N/A—Not applicable: This version does not have a disk cache.

A black and white photograph of a hand in a suit sleeve reaching upwards. Above the hand, a coin is suspended in the air, appearing to be in motion. The text is overlaid on the image, centered between the hand and the coin.

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CIRCLE 732 ON READER SERVICE CARD

FACT FILE

MS-DOS 5.0

Microsoft Corp.,
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98052;

206-882-8080.

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tation); volume discounts available through
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memory than DOS 4.0. The chart "DOS 5 Frees More Memory" shows the amount of memory left for application programs to run in after DOS 3.3, 4.0, and 5.0 are booted on a 640K machine with a CONFIG.SYS file consisting of the statements

FILES=20

BUFFERS=20

and an AUTOEXEC.BAT file containing the statements

PROMPT \$P\$G

PATH=C:\DOS

In this minimal configuration, DOS 5.0 leaves about 575K free, compared with 582K for Version 3.3 and a measly 565K for DOS 4.0.

The last bar in the chart is the most telling of all. On a 286, 386, or 486 with extended memory, you have the option of loading DOS high to free up additional room in the lower 640K. "Loading DOS high" means that most of the DOS kernel goes into the 64K region of extended memory known as the *high memory area* (HMA), which is accessible to CPUs running in real mode. Most of the system files such as IO.SYS and MSDOS.SYS reside there; so does part of COMMAND.COM. Even BUFFERS go in the HMA, provided there's room for them. As a general rule, you can increase the BUFFERS= statement in CONFIG.SYS to as much as 48 before DOS loads them

OPERATING SYSTEMS

DOS 5

into low instead of high memory.

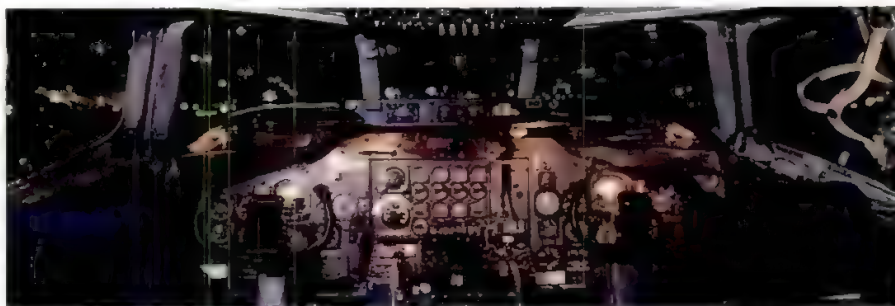
When you use this test configuration, loading DOS high left more than 620K of RAM free for applications to run in. All it takes to load DOS high is the addition of the statements

DEVICE=HIMEM.SYS

DOS=HIGH

to your CONFIG.SYS file. The first statement loads HIMEM.SYS, the device driver that DOS 5.0 uses to access memory above the 640K mark. The second one is the directive that actually loads DOS into the HMA.

If you have a 386 or 486 with at least 1MB of memory, you can utilize extended memory even further by using DOS 5.0's EMM386.EXE driver to convert unused address spaces between 640K and



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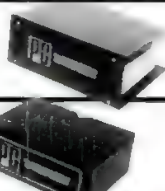
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1MB—the so-called *upper memory area*, which is normally reserved for video adapters, adapter ROMs, the BIOS, and other hardware uses—into pockets of usable RAM called *upper memory blocks* (UMBs). Once the UMBs are created, you can load TSRs and device drivers into them with DOS 5.0's new **LOADHIGH** and **DEVICEHIGH** commands, where they take nothing away from the lower 640K. If you have DOS 5.0 installed on your PC, try adding the statements

```
DEVICE=HIMEM.SYS
DEVICE=EMM386.EXE NOEMS
DOS=HIGH, UMB
```

to your **CONFIG.SYS** file (the installation does not automatically add the "UMB" to the last line). After rebooting, pick out your favorite TSR and type

```
LOADHIGH filename
```

where *filename* is the name of the TSR (as

usual, if there's not a **PATH** to where the TSR is stored, you'll need to include a pathname along with the filename). Rather than being loaded into conventional memory the way it normally would, the TSR will go into the largest available UMB. To verify this, type

```
MEM /C
```

DOS will list all of the programs installed in upper and lower memory and tell you how much space each one occupies. You should be able to see the TSR you just installed in upper memory. You can continue loading TSRs this way until there is no more space left in upper memory.

To shift your currently loaded device drivers into upper memory, go through your **CONFIG.SYS** file and replace every occurrence of **DEVICE=** with **DEVICEHIGH=**. Be sure that the **DEVICEHIGH** statements occur after the lines that load **HIMEM.SYS** and **EMM386.EXE** (**HIMEM.SYS** and **EMM386.EXE** must be loaded with **DEVICE=**; you can put **DEVICEHIGH=** in front of them, but they will still be loaded low). Then reboot and use **MEM /C** to see where the drivers were loaded. Also note how much additional memory is

available below 640K.

DOS 5.0's **EMM386.EXE** driver plays a dual role as a UMB provider for **LOADHIGH** and **DEVICEHIGH** and as an EMS provider for application programs that use expanded memory. Installed without the **NOEMS** switch, **EMM386.EXE** makes LIM 4.0 expanded memory available to the system at large, just as if your PC contained an EMS board. And if you use *Microsoft Windows* in 386 Enhanced mode, you already have a similar driver working.

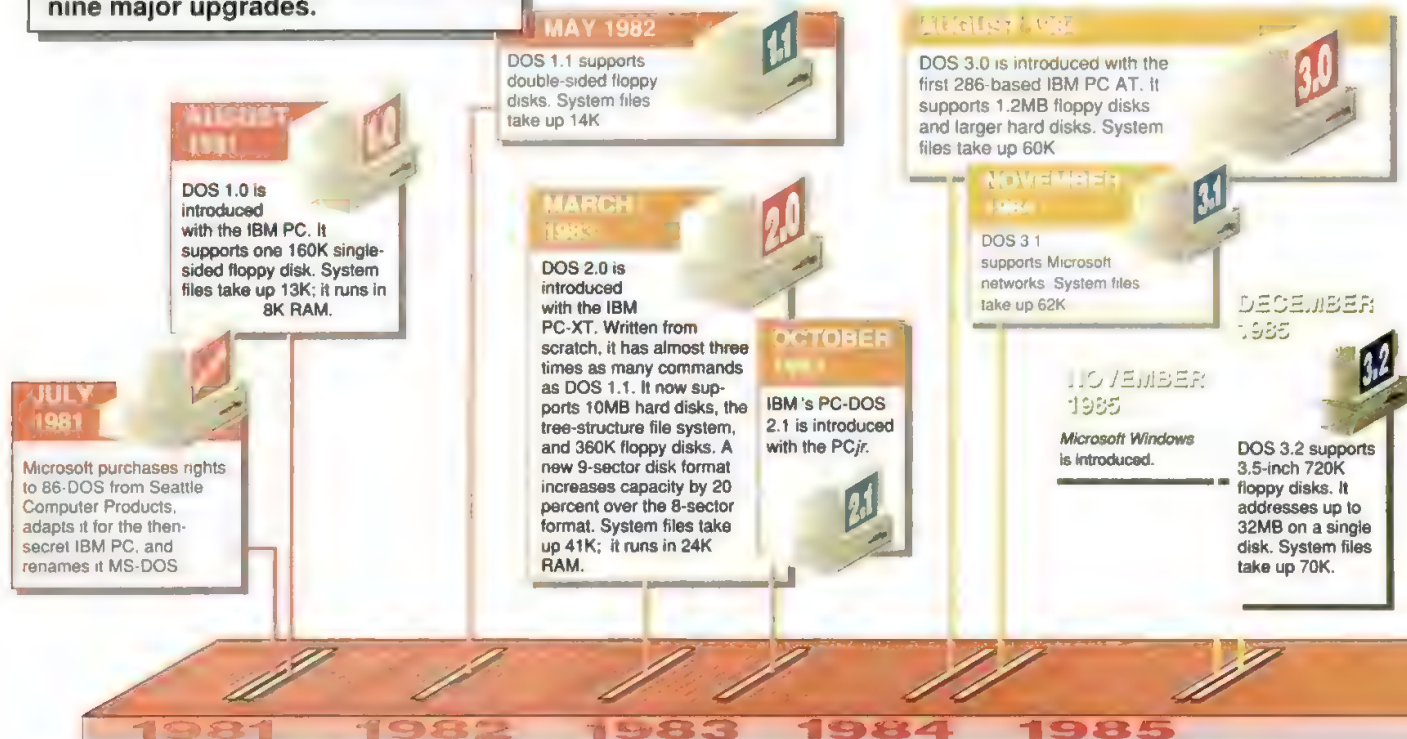
NetWare users can save between 19K and 30K by loading **IPX.COM** high, but it's more difficult to load the **NETX.COM** driver high since it requires a solid 64K block of memory.

DISK HANDLING AND DATA RECOVERY

DOS 5.0 is no slouch when it comes to disk handling, either. It supports hard disk partitions up to 2GB in size and doesn't require **SHARE.EXE** to do so. (In DOS 4.0, if you used large partitions without having **SHARE.EXE** loaded, your hard disk could be left vulnerable to data loss if you ran DOS 1.x-vintage programs such as *dBASE III* and *SideKick*, which used file control blocks for file accesses.) In fact, there is no reason to use **SHARE.EXE** with DOS 5.0 except in certain networked configurations. DOS 5.0 also supports the new 2.88MB barium ferrite floppy disks

A DECADE OF MS-DOS

Since its debut as a simple program loader ten years ago, DOS has become the platform for close to 20,000 applications; it is now installed on some 60 million PCs. Over the course of the decade, Microsoft has released nine major upgrades.



pioneered by Toshiba and comes with its own disk-caching driver, SMARTDrive, which was borrowed from *Windows* (it's probably best to use the latest version you have). And the DIR command is greatly improved, now featuring a total of seven different command-line switches. You can now list all the files on an entire disk that match a given file specification; sort listings by name, extension, size, or time stamp; list files and directories separately; and list files by attribute (all temporarily). For example, the command

```
DIR \*.BAK /S
```

lists all of the .BAK files on the current drive, while the command

```
DIR \*. * /S /O /A:H
```

lists all the hidden files on the current drive, sorted by name. Using the SET command, you can also specify the default behavior for DIR by defining a DIRCMD environment variable. For example, type

```
SET DIRCMD=/O:N
```

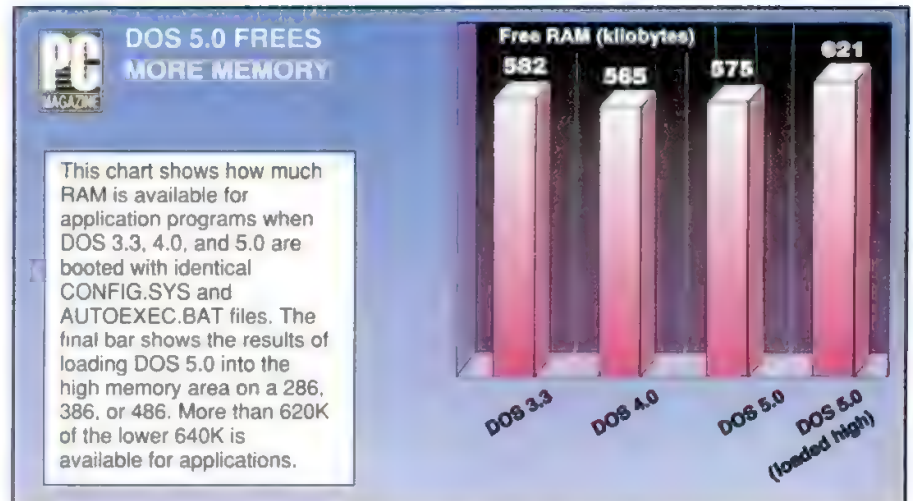
and all your directory listings will be sorted alphabetically.

DOS 5.0 also supports three different types of disk formatting. The default for-

mat, invoked when you run the FORMAT command without a /Q or /U switch, is a safe format. Safe-formatted disks can be instantly and completely unformatted by using DOS 5.0's new UNFORMAT command. FORMAT /U performs an unconditional format, which wipes out everything on the disk the way the old FORMAT used to. Finally, FORMAT /Q performs a quick format, which requires only seconds from start to finish. The quick option is only valid for disks that have been formatted at least once before, and quick-formatted disks, like safe-for-

matted disks, can be unformatted later. If you're more concerned about formatting time than with the possibility that the disk can be unformatted later on, you can combine the /Q and /U switches to speed the quick format even further.

One of the biggest new items in DOS 5.0 is the addition of three data-preservation and recovery utilities: MIRROR, UNFORMAT, and UNDELETE. MIRROR tucks away a backup copy of a disk's FAT and root directory so that the UNFORMAT command can rebuild them again. With MIRROR and UNDELETE,



APRIL 1986

The IBM PC Convertible is introduced with two 3.5-inch 720K floppy disks.

SEPTEMBER 1986

Compaq introduces the first 386-based PC.

APRIL 1987

DOS 3.3 is introduced with the PS/2. IBM's first 386-based PC. It supports new 1.44MB floppy disks and multiple partitions up to 32MB to accommodate larger hard disks. System files take up 79K; it runs in 65K RAM. IBM announces OS/2 on the same day.

NOVEMBER 1987

Microsoft Windows 2.0 and OS/2 1.0 ship

JUNE 1988

Microsoft Windows 2.1 (Windows/286, Windows/386) is introduced

NOVEMBER 1988

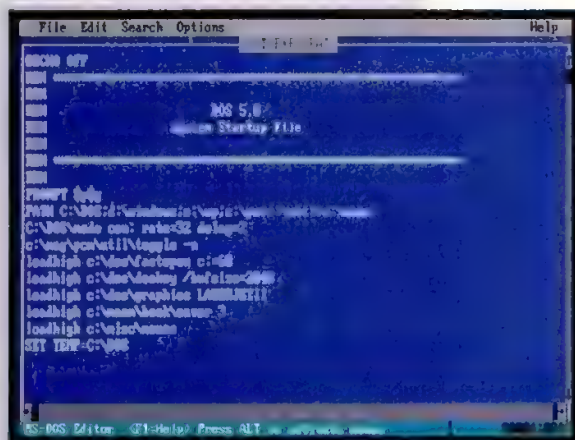
DOS 4.01 includes a shell menu interface and support for hard disk partitions over 32MB. System files take up 108K; it runs in 75K RAM

MAY 1990

Microsoft Windows 3.0 is introduced. DR DOS 5.0 is introduced

JUNE 1991

DOS 5.0 includes an improved shell menu interface, full-screen editor, unformat utility, and task-swapping ability. System files take up 118K; it runs in 60K RAM, and 45K can be loaded into HMA above 1MB to free space in conventional memory for applications.



One of DOS 5.0's most useful new features is the DOS Editor, a full-screen text editor that renders EDLIN obsolete. The Editor can be driven either by keyboard or by mouse, and it contains extensive on-line help.

you need never fear an accidental format. MIRROR will also back up a hard disk's partition tables so that you can restore them if they become corrupted. UNDELETE recovers erased files. To get a reading on what the UNDELETE command can do for you, go to any directory on your hard disk and type

UNDELETE /LIST

UNDELETE will list all the deleted files in the directory and tell you how many of them it can recover. If file deletions are a persistent problem, you can use MIRROR to install a memory-resident program that maintains a special file called a *delete-tracking file*. Delete tracking enables UNDELETE to restore some files that could not be restored using the conventional methods.

KINDER, GENTLER COMMAND LINE

Another prominent feature of DOS 5.0 is DOSKEY. DOSKEY is a command line enhancer, similar to other command line enhancers such as Chris Dunford's CED and *PC Magazine's* own DOSKEY and ALIAS. Installed as a TSR, DOSKEY adds four features to the DOS command line that you'll find yourself using all the time: command editing, command recall, command macros, and the ability to enter multiple commands on a single command line. To illustrate this, install DOSKEY with the command

DOSKEY

Better yet, if you have a 386 or 486 configured for loading TSRs high, install it in upper memory with the command

LOADHIGH DOSKEY

Then enter and execute a few commands and press the Up Arrow key a few times. You'll see the commands you just entered played back. When you find the one you want, press Enter to execute it. Or use the Left and Right Arrow keys, the Home and End keys, Backspace, Del, Ins, and other editing keys to edit it, or the Esc key to clear it. With DOSKEY, you have the same power to edit commands on the command line as you do when you edit text with a text editor.

You can display a command history—a list of all the commands buffered for recall—by typing

DOSKEY / HISTORY

You can also display a command history by pressing F7. The commands in this list are numbered, and you can execute a command by pressing F9 and then entering the command number. Better yet, you can search out a particular command by entering the first few characters of it and pressing the F8 key. For example, let's say that at some point in the past you had entered the command

FORMAT A: /F:720 /S

and that you want to execute it again. Rather than typing it back in, type

FOR

and press F8. You'll see the most recent command that begins with FOR displayed. Repeated presses of F8 will move you deeper into the command stack, each time displaying only commands that begin with those three letters.

You can also string multiple commands together by separating them with Ctrl-T, which shows up on-screen as the symbol for a paragraph marker. For example,

CLS <Ctrl-T> MEM

clears the screen and runs the MEM command. You can roll these commands into a macro by typing

DOSKEY CMEM=CLS \$T MEM

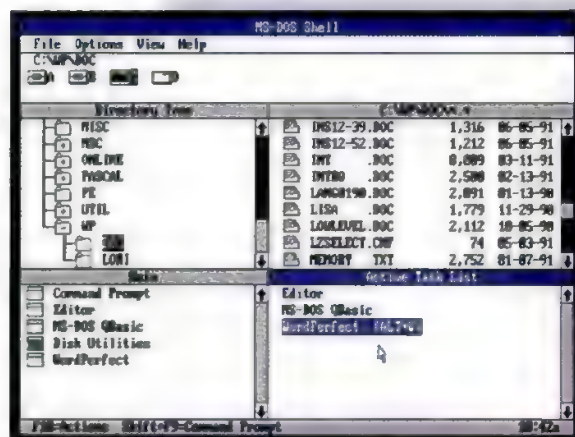
Then, typing CMEM at the DOS prompt has the same effect as typing CLS and MEM, as if CMEM were an internal DOS command (the \$T between CLS and MEM is the macro equivalent of Ctrl-T). You can incorporate any DOS command in a macro this way. For example, you could create the equivalent of the *PC Magazine* WHEREIS utility or *The Norton Utilities* FileFind to locate files on-disk with the command

DOSKEY WHEREIS=DIR \%1 /S

The \$1 is a placeholder for the first parameter following the macro name, similar to %1 in batch files. Once this macro is defined, typing

WHEREIS *.BAK

lists all the .BAK files on the current



Through the DOS 5.0 Shell, you can load several programs into memory at once and switch between them without losing context. A list of active tasks appears in the lower-right-hand corner of the screen. Here, *WordPerfect*, QBasic, and the DOS Editor are all active simultaneously.

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Notebook Users: Print Without A Printer!

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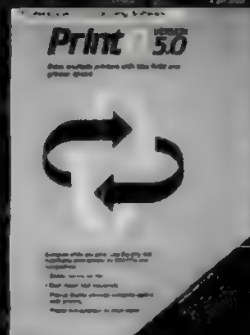
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PC WEEK'S WARNING: "PrintQ may become addictive...."

drive. You can list all the currently defined macros by typing `DOSKEY/MACROS` and erase them all by pressing `Alt-F10`. Hint: If you run out of room for defining macros, or if you would like to increase the number of commands that are stacked for recall, you can use the `/B` switch to install `DOSKEY` with an increased buffer size.

FORGET EDLIN

Since Version 1.0, DOS has come with `EDLIN`—the crude, line-oriented text editor to be relied upon only in a clutch. `DOS 5.0` still has `EDLIN`, but it also comes with the `DOS Editor`, a full-screen text editor that operates under mouse or keyboard control and features an extensive on-line help system, support for cut, copy, and paste operations, and more. The Editor is invoked with the `EDIT` command, and it will edit files as large as the available memory permits. Use the `DOS Editor` one time to make changes to a `CONFIG.SYS` or `AUTOEXEC.BAT` file and you'll never go back to `EDLIN` again.

TASK SWITCHING

You may think you have no need for a `DOS` shell, but the one shipped with `DOS 5.0` (a totally rewritten shell that bears more resemblance to *Microsoft Windows 3.0's* File Manager than to the `DOS 4.0` Shell) may cause you to think again.

Through the `DOS 5.0` Shell, you can load several programs at once and switch back and forth between them without losing context. In other words, when you exit *WordPerfect* and then come back to it, it remains unchanged, with the document file still loaded. This kind of task switching, which has made *Software Carousel* so popular, is available in `DOS 5.0` only through the Shell.

Just below the menu bar is a row of drive icons, which you can click on to change drives. The rest of the screen is divided into four windows: the *directory list* window (where the directory tree for the current drive appears), the *file list* window (where a list of files in the current directory appears), the *program list* window (where you can launch a program by clicking on an icon), and the *active task list* window (where a list of the programs currently loaded is displayed). You can switch to one of them by clicking on its icon in the task list or by pressing a user-defined hotkey.

Don't be fooled into thinking that `DOS` is actually multitasking here; it's not.

When you switch away from a program, it's suspended until you reactivate it. The switch can be quite slow, because `DOS` will usually have to swap the current application to disk and read the next one back in. Unfortunately, it won't use the extended or expanded memory available in your system for swapping. Perhaps that's something we'll see in the next release—along with some form of multitasking on the 386 using the 386's

Virtual 86 mode as a base.

Here's a quick tip: `DOS 5.0's` `REN` command still won't rename a subdirectory from the prompt, but the `RENAME` command in the `DOS` Shell will. To rename a subdirectory, highlight it in the directory tree window, select `RENAME` from the Shell's File menu, and enter the new name. Even if you don't use the Shell

```

-ABC\doskey -
Edit command line: replace MS-DOS command, and create macros.

DOSKEY [/REINSTALL] [/SIZE=size] [/MACROS] [/HISTORY]
[/SWITCH] [/MODE=MODE] [macro=macro]

/REINSTALL    Installs a new copy of Doskey.
/SIZE=size    Sets size of command history buffer.
/MACROS       Displays all Doskey macros.
/HISTORY      Displays all commands stored in memory.
/SWITCH       Specifies that new text you type is inserted in old text.
/MODE=MODE    Specifies that new text overwrites old text.
macro=macro   Specifies a name for a macro you create.
text          Specifies commands you want to record.

If and DOWN (DOWN) commands: ESC clears command line; F7 displays
command history; ALT+F7 clears command history; F8 searches command
history; F9 selects a command by number; ALT+F10 clears macro definitions.

The following are some special codes in Doskey macro definitions:
^X    Command separator. Allows multiple commands in a macro.
%1-%9 Batch parameters. Equivalent to %1-%9 in batch programs.
*     Symbol replaced by everything following macro name on command line.

END

```

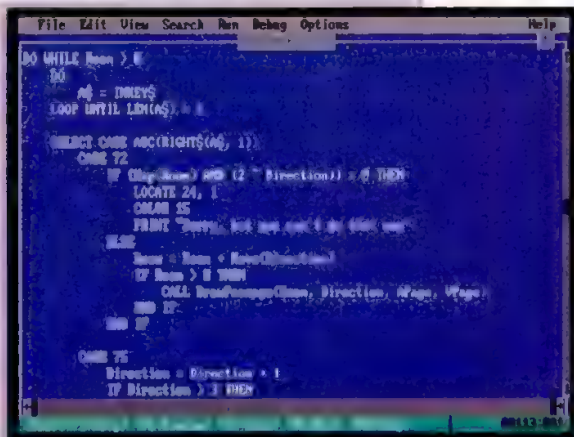
You can get help for any `DOS 5.0` command by running it with a `/?` switch or by typing `HELP` followed by the command name. The help listing for `DOSKEY` is shown here.

regularly, it's worth the time to fire it up when you need to change the name of a subdirectory.

QBASIC INTERPRETER

`GW-BASIC` and `BASICA` aficionados will be glad to get their hands on the `QBasic` Interpreter, a new `BASIC` interpreter modeled after `Microsoft's` `QuickBASIC` compiler. `QBasic` supports all of the elements of structured `BASIC` programming, including `SELECT CASE` constructs, `IF-THEN-ELSE` blocks, procedural blocks (subprograms and functions), local variables, `DO-WHILE` and `DO-UNTIL` loops, and more. It also features an integrated debugger, long integers, `IEEE` real numbers, and user-defined data types, and it supports recursive procedures and `EGA` and `VGA` screen modes; in short, it has just about everything you could ask for from a `BASIC` interpreter and then some. It also runs programs written for `GW-BASIC` and `BASICA`, usually without modification, even if they contain line numbers.

If you're looking through the box that `DOS 5.0` came in to find a `QBasic` manual, don't waste your time. It doesn't come with a manual—at least not the kind of manual you're thinking of. All the documentation is on-line, and the Help system is extensive, to say the least. In case you've never programmed in the `QuickBASIC` dialect of the `BASIC` language



`DOS 5.0's` new `QBasic` Interpreter is based on `Microsoft's` `QuickBASIC` compiler. `QBasic` includes support for structured programming, an integrated debugger, and on-line documentation. It runs programs written for `GW-BASIC` and `BASICA` as well.

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before, your DOS floppy disks contain several sample programs to get you started.

PAGING PETER NORTON AND FRIENDS

As you read through what's new and great in DOS 5.0, you have to wonder what happens to the third-party utility makers who have made millions filling the gaps in DOS—companies like Qualitas (386-MAX), Quarterdeck (QEMM-386), Symantec (*The Norton Utilities*), Central Point Software (*PC Tools*), and others. The short-term answer is that they'll be hurt, some worse than others, but the smart utility designers have already upgraded their products to capitalize on the new features of DOS 5.0. On the same day that Microsoft announced DOS 5.0, Symantec announced the new *Norton Utilities*, Version 6.0. *PC Tools*, Version 7.0, has been out since June, and Central Point Software is cleverly positioning it as a companion to DOS 5.0, not as a competitor (it was from Central Point Software that Microsoft licensed DOS 5.0's MIRROR, UNFORMAT, and UNDELETE utilities).

Symantec and Central Point may actually profit from the emergence of DOS 5.0. Version 6.0 of *The Norton Utilities* features several new and upgraded utilities, including a complete and total replacement for COMMAND.COM called NDOS (derived from JP Software's popular 4DOS) that provides everything DOS 5.0's DOSKEY utility does and then some, all in as little as 1K of memory. *PC Tools*, Version 7.0, features similar enhancements, including new *Windows* undelete and hard disk backup utilities. Despite the fact that DOS now contains its own utilities for recovering deleted files and unformatting hard disks, there are still plenty of reasons to buy a set of utilities like *The Norton Utilities* or *PC Tools* to round out the package—perhaps now more than ever, thanks to the slew of enhancements in the latest editions.

Makers of 386 memory managers will take a harder hit. DOS 5.0's EMM386.EXE memory manager won't do everything 386MAX or QEMM-386 will do—for example, swap out slow ROM for fast RAM to boost system performance or automatically optimize your system's configuration to take advantage of upper memory—but the truth is that it does the two most important things that these products do: load TSRs and drivers high and emulate LIM 4.0 expanded memory with extended memory. If you buy any 386 memory manager right now,

OPERATING SYSTEMS

DOS 5

you're paying good money just for incremental features, but like the utilities makers, the memory management vendors are currently enhancing their products to provide extra benefits.

It will also be interesting to watch the war for market share being waged between MS-DOS 5.0 and Digital Research's alternative, DR DOS 5.0. Though MS-DOS 5.0 moves much closer to DR DOS than DOS 4.0 did, on a feature-by-feature basis, DR DOS 5.0 is still the technological winner by a wide margin, featuring a more automated install program, a built-in utility for transferring data between PCs via serial cable, password-protected files and subdirectories, and more. DR DOS 6.0, already in testing and slated for release sometime this fall, promises to offer even more, including a more powerful file system, increased security features, greater utilization of high memory, and possibly some form of multitasking for DOS applications.

Despite all this, DR DOS still has one strike against it: user perception. In the minds of most users, it's a mere clone of the IBM PC operating system. This belief alone will keep many users from ever seriously considering it.

Another point in MS-DOS 5.0's favor is its upgradability from previous versions, which are available for as little as \$40. By contrast, DR DOS 5.0 lists for \$199, so even at street prices you pay more for the clone than you do for the original. For many, that's too much to swallow.

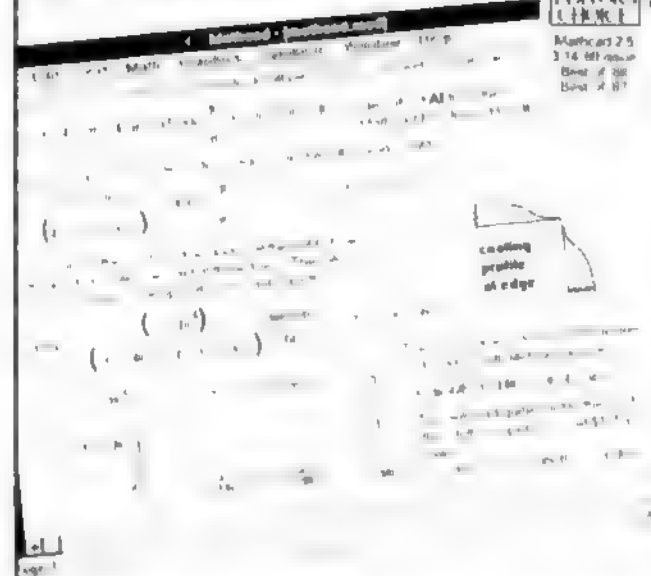
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Without a doubt, MS-DOS 5.0 is the best MS-DOS ever. You'll find it packed with new features, including a GRAPHICS command that works with EGA and VGA screens and LaserJet printers, an ATTRIB command that lets you toggle hidden and system file attributes as well as archive and read-only, a SYS command that works on any disk, and a RESTORE command that works with files created by any version of BACKUP. Is it worth the cost of an upgrade? You bet. With its many time- and memory-saving features, DOS 5.0 is worth whatever you pay for it. ■

Jeff Proise is a contributing editor of PC Magazine and the author of DOS 5 Techniques and Utilities, published by Ziff-Davis Press.

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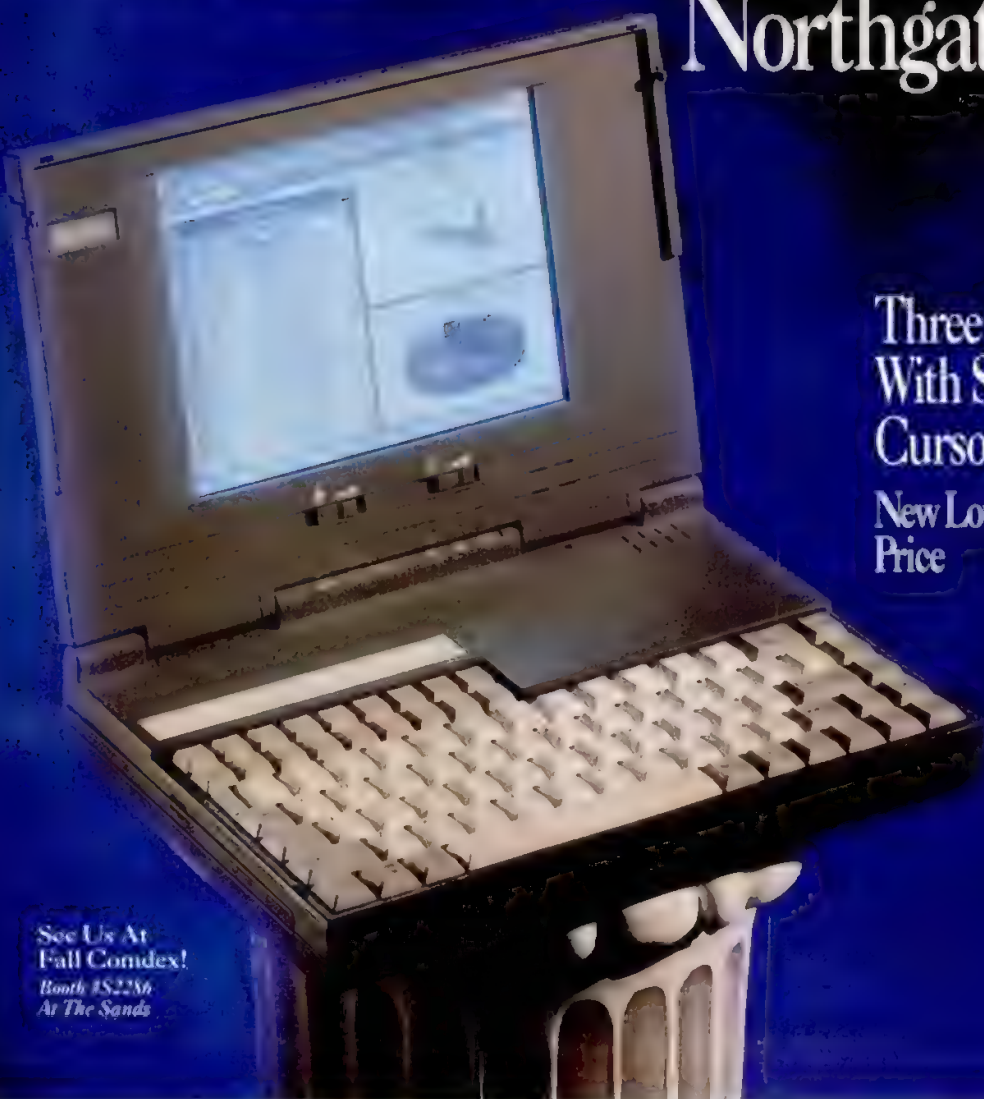
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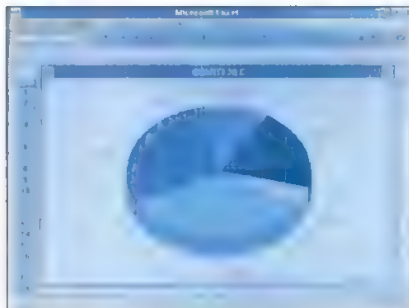
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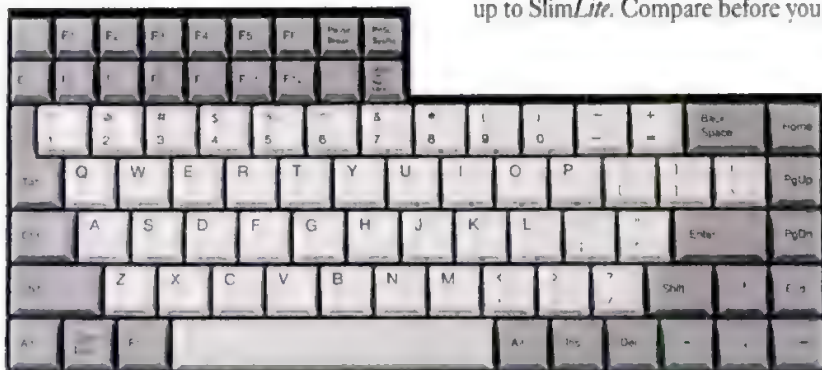


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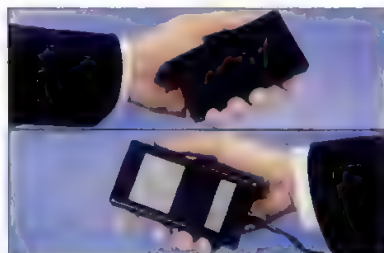


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If Windows seems sluggish, try upgrading your video card before you buy a new computer.

PC Magazine Labs tests 21 Super VGA boards that provide solid performance and flicker-free images.

SVGA BOARDS:



Fast Enough for Windows, Cheap Enough for You

Until recently you probably have not given much thought to your graphics adapter. Whatever card came in your PC is probably the one you are using today. After all, it ran fine under DOS. But now that you have moved into the *Microsoft Windows* arena, you need a faster board to get around the new graphics-intensive neighborhood.

But choosing the best video card for *Windows* is more complicated than simply shopping for the best price. Today's Super VGA market place is filled with tantalizing possibilities. It's all very exciting, but it is also confusing. Is the right

by **Mary Kathleen Flynn**
and **Robert W. Kane**

HARDWARE

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video controller a frame buffer, a graphics accelerator board, or a coprocessor board? Is one chip set faster than the rest, or is performance all in the driver? Do you need 1,024-by-768 resolution, or can you stop at 800 by 600? Do you want to work in 256-color mode, or are 16 colors enough? And what about those ads you have seen for 32,000 colors?

To help you find the right path through the decision tree, *PC Magazine* has published three articles this year, with this as the third. Here we will focus on Super VGA boards, which lie at the heart of today's video market. Ranging between \$150 and \$550, these 1MB boards boost *Windows* without busting your budget.

We also summarize our findings, which we gathered from testing nearly 50 graphics adapters over the last six months, in the chart "Windows Performance Snapshot: Coprocessors vs. Frame Buffers." For background see "Boosting Video Performance Under Windows 3.0," *PC Magazine*, February 26, 1991. And if the cards in this article don't provide enough performance for your needs, see our review of 15 high-end coprocessed boards, which are fast but expensive (between \$700 and \$3,700) in our June 25, 1991, article "1,024-by-768 Coprocessed Graphics Adapters: High Resolution and High Speed."

THE RIGHT FEATURES

For most PC business users, Super VGA boards are a good bang-for-the-buck solution. While they are not the absolutely fastest cards you can buy, they are quick enough for day-to-day *Microsoft Windows* word processing and spreadsheet tasks. And they offer the right feature set—if you stick with the criteria we used

to screen graphics adapters for this story: Each had to support noninterlaced Super VGA (800 by 600) resolution in standard 16-color and extended 256-color modes. Each also had to display standard Super VGA mode at a 72-Hz vertical refresh rate. We tested them with the maximum memory available: usually 1MB.

■ Look for a 72-Hz vertical refresh rate.

The refresh rate refers to the number of times the screen is redrawn each second. The higher the rate, the less flicker you will see. For Super VGA modes, VESA (Video Electronics Standards Association) has defined 72 Hz as its official



standard vertical refresh rate. It has also defined 56 and 60 Hz as its manufacturer's guidelines. (VGA has a vertical refresh rate of 60 or 70 Hz.) We recommend the 72-Hz rate for Super VGA modes. Most boards drop down to a lower rate in display modes higher than standard 16-color Super VGA. (Check the reviews for this information.)

The reason VESA chose 72 Hz—not 75 Hz or any other number—is because the same video bandwidth produces a 1,024-by-768-pixel mode at 60 Hz. Higher-frequency monitors are more expensive, which is why VESA is expected to pass only a 70-Hz standard rate for 1,024-by-768 monitors this fall.

To further reduce eyestrain, try Soneira's \$79 *DisplayMate* (908-747-6886). This utility includes hundreds of test patterns and automatic diagnostics that tell you how to adjust your monitor and graphics adapter. Large shops may want to consider Extron Electronics' RGB 188 Plus (\$550 plus \$85 for cables), which PC Magazine Labs uses to ensure that adapters run at 72 Hz (213-802-8804).

■ **Get 1MB of display memory.** For a 1,024-by-768 resolution with 256 colors, you need 1MB (actually you need only 786,432 bytes, but since memory doesn't

come in that configuration, look for 1MB). With 512K you can go to only 16 colors in high-resolution mode. (See the table "More Memory, More Modes.")

Most 512K boards cannot handle the 72-Hz Super VGA refresh rate. The \$189 ATI VGA Integra and the \$229 Genoa SuperVGA 6400VC are exceptions, which is why we agreed to review them. If you opt for these, expect to see slower performance with 256 colors. In 256-color modes, they came in behind every other board we've tested this year on PC Labs' *Windows* tests.

Windows 3.1 is expected to allow unused memory to cache off-screen bmaps, which means more memory will improve performance with drivers optimized for Version 3.1.

■ **Weigh price against performance carefully.** Super VGA boards are getting cheaper all the time. The original filter for this roundup was a list price of \$700 or under. By press time, all 21 boards had dropped below \$550. Most of the boards reviewed here use DRAM instead of VRAM, which means most fall within the \$200 to \$400 range. But VRAM—with its accompanying high price tag—does offer a payoff: speed. The two boards that used VRAM—the \$549 Desktop Quikdraw VGA and the \$499 Video Seven VRAM II—were the most expensive but were also the top performers.

DUMB FRAME BUFFERS

Speeding up *Microsoft Windows* video can be done two different ways: in software or in hardware. The software approach means writing a driver that is optimized for the environment. Microsoft has recently begun to emphasize the role hardware can play. At the Spring Comdex VESA meeting, Keith Laepple, Microsoft program manager for the DOS/Windows Business Unit, divided video controllers into three categories: dumb frame buffers, fixed-function graphics accelerators, and fully programmable coprocessors. The Super VGA boards we review here, priced from \$139 to \$549, are considered dumb frame buffers. Accelerated boards are expected to start at \$150 and go up to \$600. And coprocessed boards range from about \$700 to \$3,700.

Coprocessors and accelerators have much in common, and in fact the two terms are not mutually exclusive. The difference is that coprocessors are programmable while accelerators are fixed in their functionality. Intelligence is what

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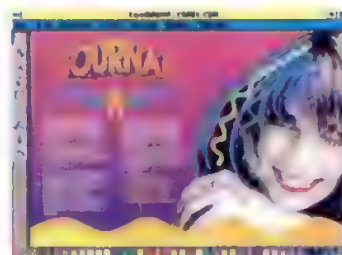
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WINDOWS PERFORMANCE SNAPSHOT: Coproprocessors vs. Frame Buffers

by Mary Kathleen Flynn

To get the best video performance under *Microsoft Windows*, buy a board with a fully programmable graphics coprocessor. A graphics coprocessor offers two advantages: It is specifically designed for video functions, and it lightens your CPU's workload. In virtually all resolution/color combinations, coprocessed boards outperform frame buffers (which have no built-in intelligence). The only downside to coprocessed boards is that they are expensive: List prices range from about \$700 to \$3,700. For a review of 15 coprocessed boards, see "1,024-by-768 Coprocessed Graphics Adapters: High Resolution and High Speed," *PC Magazine*, June 25, 1991.

Graphics accelerator chips—which contain such specific *Windows* functions as BitBlts, area filling, and line drawing—also promise performance gains. The category is still new, and the line between accelerators and coprocessors is blurry. But you will see the term used this fall to market boards based on new chips from ATI Technologies Inc., Chips and Technologies, S3, VDI, and Weitek Corp. You can also expect to see *Windows* functions built into the next generation of Super VGA chip sets from ATI, Orchid Technology, Tseng Laboratories, Video Seven/Headland Technology, and Western Digital Imaging. A beta version of the \$599 1MB ATI Graphics Vantage beat everyone else in Super VGA modes. We were equally impressed by a sample board based on S3's accelerated 86C911 Super VGA controller.

The 21 Super VGA boards we review in this article (as well as the Western Digital 1024 DX previewed here) are all dumb frame buffers. Without the assistance of a coprocessor or an accelerator, their performance is noticeably slower than intelligent boards, especially in high-resolution modes with more colors. On our tests, the fastest frame buffers (the Desktop Quikdraw VGA, the Video Seven VRAM II, and the Western Digital 1024 DX) took

roughly 1.5 to 3 times as long as the fastest coprocessed boards, depending on the display mode. But with prices ranging from \$139 to \$549, the Super VGA boards reviewed here provide an acceptable combination of performance and affordability for most PC business users.

PC Labs has tested
nearly 50 video boards
and analyzed 8,500
results this year. All this
data points to one piece
of advice: If you can
afford it, buy a board with
built-in intelligence—
either a coprocessor or a
graphics accelerator.

METHODOLOGY

This graph summarizes our findings based on testing nearly 50 video boards for this issue and for two earlier issues this year. To get the times reported here, we added up each board's scores on the full suite of PC Magazine Labs' Graphics Performance Tests for *Microsoft Windows* 3.0, which we ran on our standard test-bed, the Compaq Deskpro 386/25e. For speedy *Windows* operation, look for boards with times of 650 milliseconds or less. (For additional test results, see the performance tests that accompany this story, as well as "Boosting Video Performance Under *Windows* 3.0," February 26, 1991, and "1,024-by-768 Coprocessed Graphics Adapters: High Resolution and High

Speed," *PC Magazine*, June 25, 1991.)

For each product category, we have highlighted noteworthy performers in each display mode, including the fastest and slowest. Where meaningful, we have indicated the board that generated the median time for all the products in that category.

Coprocessed-board results come from the June 25, 1991, article. The data for VGA and high-resolution modes represents all 15 coprocessed boards reviewed then. But for Super VGA modes, we report the times only for those boards that use their coprocessors in 800-by-600 modes.

The graphics accelerators we tested were not shipping end-user products. The ATI Graphics Vantage was still in beta, and the S3 86C911-based board was a sample. The only other accelerator available at press time was the XGA video controller in the newest IBM PS/2s. But because XGA is currently implemented on a 486 platform, an apples-to-apples comparison with our 386-based results is not possible. For more on XGA, see the sidebar "XGA: IBM's New Hi-Res Spec" and "IBM PS/2 Models 90 and 95: True 486 Power at Last" in the February 26, 1991, issue of *PC Magazine*.

For a complete set of results for the 21 Super VGA boards reviewed in this article, see the performance tests in this issue. Because these boards are not designed for high resolutions, we tested only a sampling of them at the high-resolution modes.

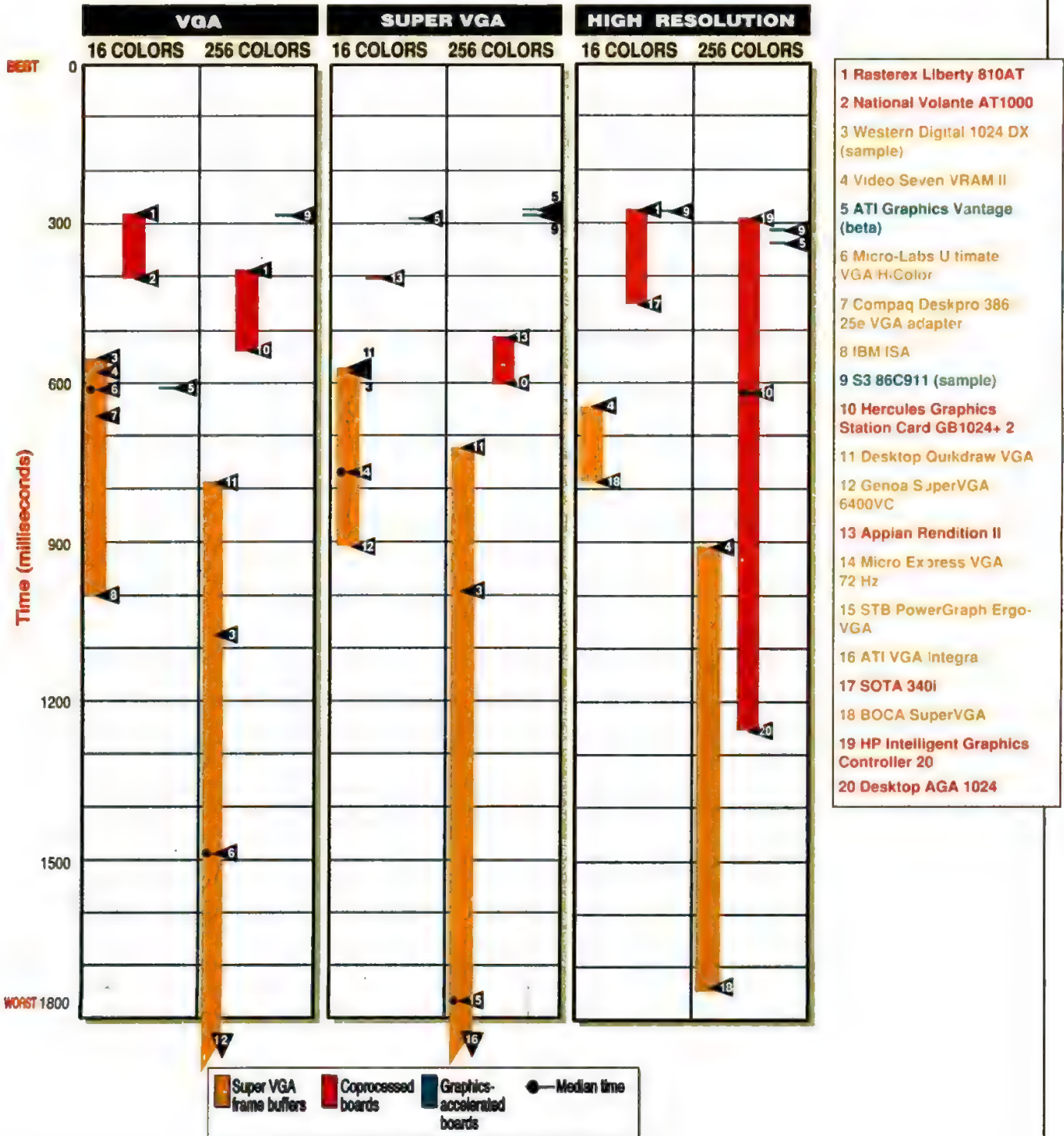
Western Digital is not marketing its 1024 DX frame buffer directly to end users, and its OEM customers were not shipping products yet. We tested a sample unit supplied directly by Western Digital. (See the sidebar "From the OEM Front: Western Digital's 1024 CX and 1024 DX.")

For the sake of comparison, we have also included VGA-mode results for the Compaq Deskpro 386/25e's built-in graphics adapter and IBM's ISA-bus VGA controller. ■

HARDWARE

SVGA GRAPHICS ADAPTERS

The fastest coprocessed boards perform up to three times as fast as the quickest Super VGA frame buffers, but they also cost considerably more. Graphics accelerators may provide the best bang for the buck.



HARDWARE

SVGA GRAPHICS ADAPTERS

makes them both different from the dumb frame buffers.

Most VGA and Super VGA controllers are dumb frame buffers and manage memory much in the same way as expanded memory boards do. They organize display memory into 64K segments, the largest video memory window the CPU has access to at one time. The computer draws graphics images by writing bytes into video memory, and the faster the CPU can read and write information to and from display memory, the faster it can update the display. A significant bottleneck is that everything has to be snaked through the 8-MHz I/O bus. By relying on the CPU, frame buffers end up reducing overall system throughput.

GRAPHICS ACCELERATORS

The next step up from dumb frame buffers is what Microsoft is calling fixed-function graphics accelerators. These controllers manage memory much in the same way that Super VGA controllers do, but they also have specific graphics functions—such as BitBlts, line drawing, and area filling—hard-coded into the controller.

How a line gets drawn on-screen illustrates the difference between dumb frame buffers and accelerators. A Super VGA controller requires the CPU to calculate each pixel (including color information) to make up the line. The graphics accelerator, on the other hand, just needs to know the source point, destination point, line width, and color. Once given this information, the accelerator performs the rest, putting all the appropriate pixels on the screen to create a correctly sized line of the right color.

IBM's XGA controller, used in the newer 386- and 486-based MCA PS/2s, is an accelerator. XGA also puts the cursor in hardware, thereby speeding it up. Hardware cursors will soon show up in other video subsystems. (For more on XGA, see the sidebar "XGA: IBM's New Hi-Res Spec" and the story "IBM PS/2 Models 90 and 95: True 486 Power at Last" in the February 26, 1991, issue of *PC Magazine*.)

ATI Technologies Inc., Chips and Technologies, S3, Video Dynamics Inc. (VDI), and Weitek Corp. have all an-

nounced accelerators. The only end-user product to arrive in time was a beta version of the \$599 1MB ATI Graphics Vantage—which has BitBlts, area filling, and line drawing in hardware. We were very impressed by the beta board's speed. In Super VGA modes, it outran every other board we tested this year—even boards such as the Appian Rendition II and the Hercules Graphics Station Card GB1024+2, which use coprocessors in Super VGA. (See the sidebar "ATI Graphics Vantage: Coprocessed Speed, Frame-Buffer Price.")

S3 (pronounced "S cubed") is a new company founded by two Chips and Technologies founders, Dado Banatao and Ron Yara. S3 is calling its single-chip 86C911 controller a GUI (graphical user interface) accelerator. It provides VGA compatibility and has hard-coded BitBlts and image transfers. Elite Microelectronics (408-943-0500) and OPTi (408-980-8178) have announced they will soon deliver 86C911-based motherboard chip sets. A sample from S3 delivered superb performance on our tests.

VDI was unable to provide us with a production unit of its \$599 FlashVGA.

Are You Looking At 386's When You Can Afford A 486?



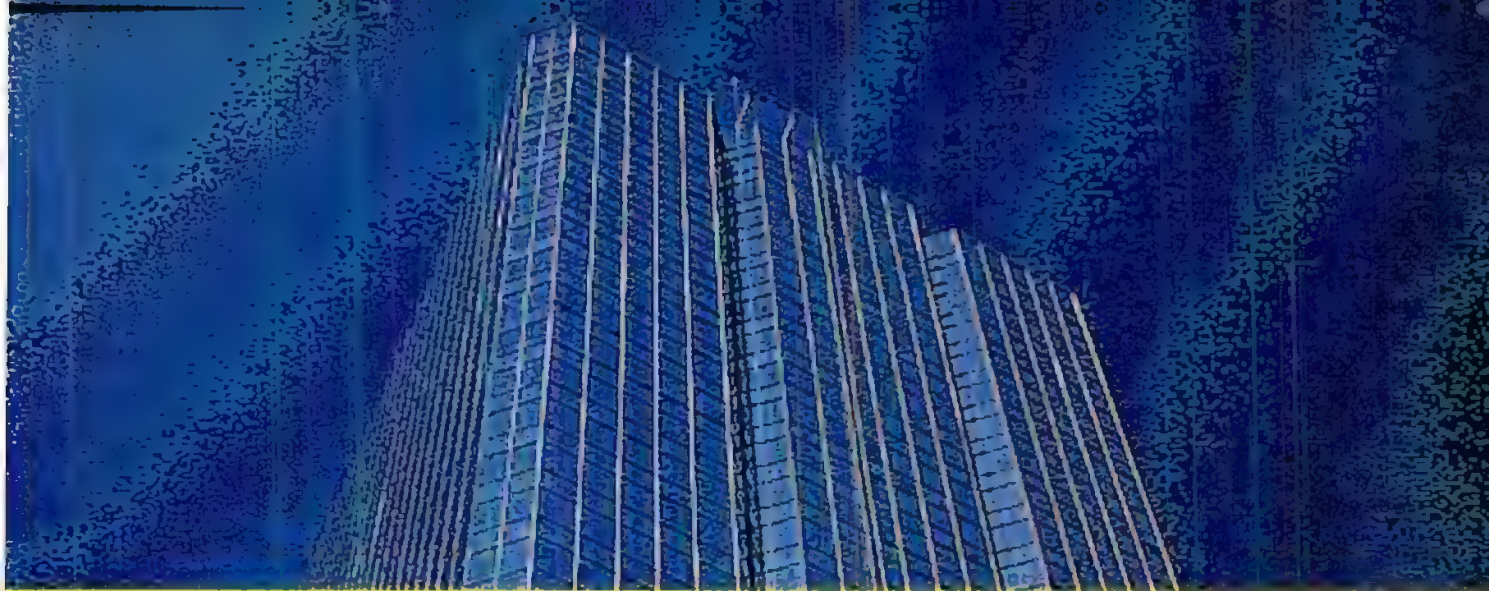
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The board couples Super VGA with hardware acceleration of BitBlts, line drawing, and area filling (800-243-3527 or 415-863-3023).

Weitek is calling its W5086 a user interface controller. The single-chip controller includes BitBlts and line drawing (but not area filling). Add-in cards based on the W5086, which also provides VGA compatibility, are expected later this fall—priced as low as \$150. (For more on the W5086, see Pipeline, *PC Magazine*, July 1991.)

But these five companies are not the only players in the accelerator game. *Microsoft Windows* functions will be built into upcoming Super VGA chip sets from ATI, Tseng Laboratories, Video Seven/Headland, and Western Digital Imaging.

TRUE COPROCESSORS

The highest level of video intelligence found in today's PC video controllers are true coprocessors. By Microsoft's definition, coprocessors must be fully programmable; that is, they must be able to run a C program.

Programmability provides insurance against the future. If someone dreams up a new graphics function tomorrow, a new driver can be written to take advantage of it. Programmable coprocessors include the Texas Instruments TMS340x0 family and the Chips and Technologies PUMA (programmable universal micro accelerator). The coprocessed \$799 ATI 8514/Ultra and \$995 National Volante AT1000 boards each won an Editors' Choice award in our June 25, 1990, article. Note: Most coprocessed boards do not use their coprocessors in Super VGA modes; the \$1,295 Appian Rendition II and the \$1,495 Hercules Graphics Station Card GB1024+2 are exceptions.

We also saw a beta version of Ergon's \$499 Windows Accelerator Kit, which is based on the PUMA chip. A VGA add-on card, Ergon's Windows Accelerator Kit is designed to work with your VGA or Super VGA card to boost *Windows* performance—although not on the functions we test under *Windows*. Ergon's \$129 HPLaserJet II/III Adapter, designed to speed up printing, is based on the PUMA chip as well (601-856-4121).

Don't get hung up on the terms "accelerators" and "coprocessors." They are bandied about casually by people in the industry. (The programmable PUMA chip, which is marketed as a *Microsoft Windows* accelerator, is a good case in

point.) Just keep in mind that boards with hardware-assisted graphics functions provide you with greater performance than dumb frame buffers.

PERFORMANCE COMPARISONS

Based on PC Labs' tests of nearly 50 video cards this year, it is clear that intelligent boards are faster than Super VGA cards—especially as you move up the resolution/color curve. In high-resolution 256-color mode, the fastest coprocessed board (the HP Intelligent Graphics Controller 20) performed our *Windows* test more than three times as fast as the quickest Super VGA board in that mode (the Video Seven VRAM II). But in standard 16-color VGA and Super VGA modes, the fastest Super VGA boards approach coprocessed performance. Since PC business users spend most of their time in these modes, speedy Super VGA boards are good enough for most of us.

To identify the fastest graphics adapters, we use two test suites: PC Labs' VGA performance tests and *Windows* tests. The VGA tests measure the raw speed of the controller and BIOS. The *Windows* tests measure the board as a whole system: controller and *Windows* driver. So while the VGA tests indicate the potential inherent in the chip set, the *Windows* benchmark tests show you how fast the board works with the current driver.

As the performance results illustrate, there is little correlation between the two sets of tests. In other words, the throughput winners were not the real-world winners. A recent study done by video chip set maker Oak Technology, which it calls "Interpreting VGA Benchmarks," compares the results from many different tests (including our *Windows* tests) and finds no correlation among the results from hardware-, BIOS-, and application-based tests. Oak's conclusion is that hardware tests provide no relevant information for end users. Without going that far, PC Labs does advise you to pay more attention to the *Windows* benchmark tests results than the VGA ones. (For a free copy of Oak's study, call 800-842-6251.)

THE CONTROLLER COMPONENT

While 13 of the 21 Super VGA boards we tested are based on the Tseng chip set, we also saw controllers from six other manufacturers: Ahead, ATI, Chips and Technologies, Genoa, Trident, and Video



WHOSE VIDEO BOARD
IS IN YOUR PC?
A SURVEY OF THE TOP
25 SYSTEMS VENDORS

Whose video board are you using? Many PC users cannot answer this question; they only know they use the boards that came with their PCs. To help you identify your graphics adapter, we asked the top 25 PC vendors which boards were installed in most of the 386 and 486 systems they sold during the last year. Based on their answers, chances are your video board was made by Tseng Laboratories or Western Digital.

SYSTEMS VENDOR	VIDEO BOARD VENDOR
Acer	ATI
ALR	Western Digital
AST	AST (Western Digital)
AT&T	Western Digital
Austin	Tseng
Compaq	Compaq
CompuAdd	CompuAdd (Tseng)
Dell	Western Digital
Epson	Seiko-Epson
Everex	Everex (Tseng)
Gateway 2000	Diamond
Hewlett-Packard	Video Seven/Headland
Hyundai	ATI
IBM	IBM
Memorex Telex	Video Seven/Headland
NCR	NCR
NEC	Western Digital
Packard Bell	Info not available
Swan/Tussey	Swan (Tseng)
Tandy/GRID	Tandy
Unisys	Unisys (Western Digital)
Wang	Wang (Chips and Technologies)
Wyse	Wyse
Zenith	Texas Instruments
Zeos	Diamond

To determine the top 25 systems vendors, we used market research data from Computer Intelligence, Dataquest, InfoCorp, and International Data Corp. Surprisingly, Packard Bell declined to answer our survey. We list the vendors in alphabetical order, and in cases where the systems vendor manufactures the graphics adapter, we list between parentheses what chip set the board uses.

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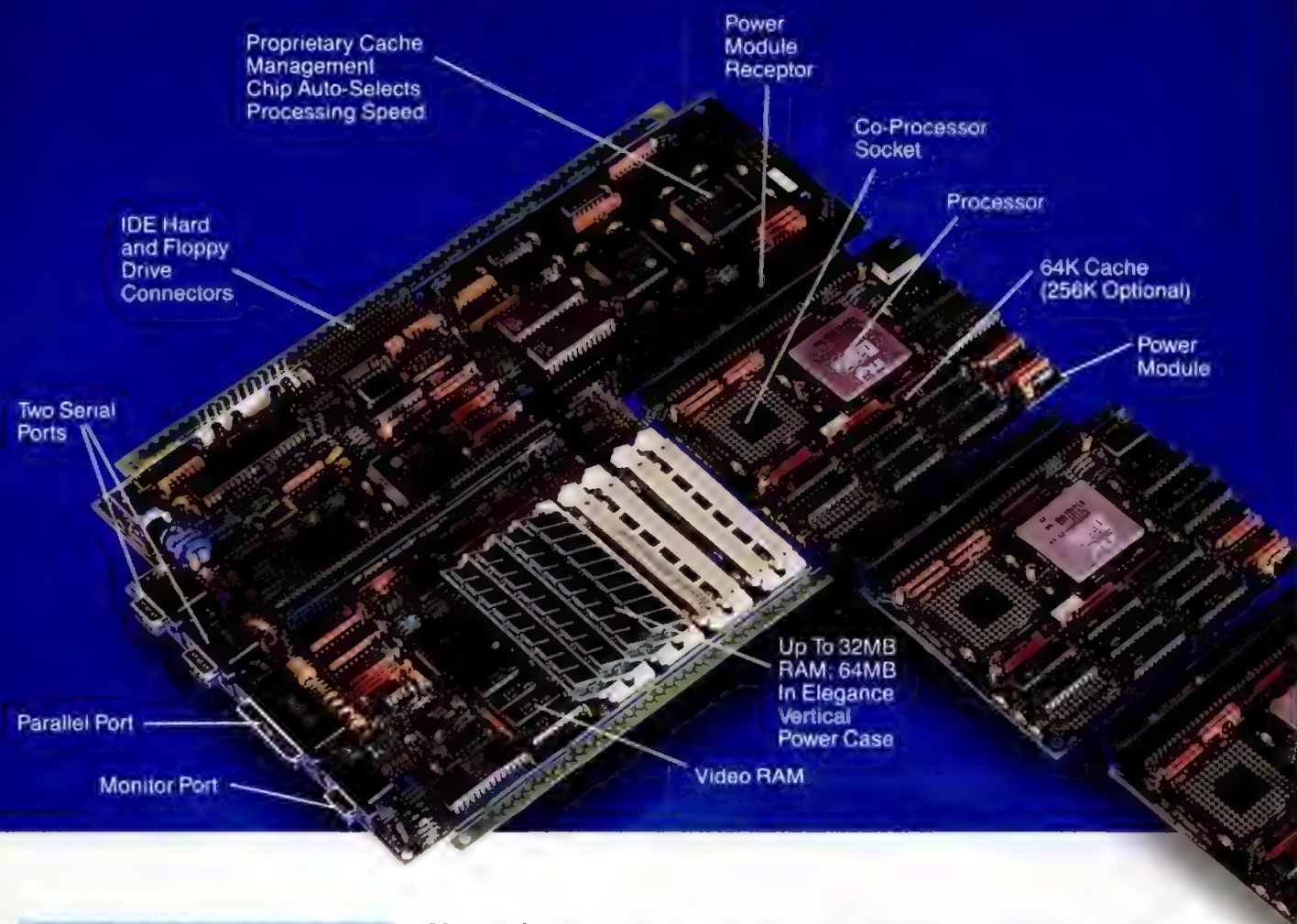


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DELL \$1999.00! Their sales reps will tell you "there's a lot of value here at Dell." It doesn't show in their prices. You'll fork over \$1999.00 to upgrade a Dell 386/33 to a 486/33. If you paid the \$299.00 they charge for 32K cache in your Model 325P, kiss it goodbye! Dell's 486/33 has NO external cache memory capability and they won't buy back the module or the now worthless cache card! And these guys made a big to-do over Compaq's high prices!

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- 150 watt power supply
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- Intel and Weitek math coprocessor support
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- Microsoft® Windows™ and mouse
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HARDWARE

SVGA GRAPHICS ADAPTERS

Seven/Headland. To find out which PC vendors use which video controllers, see the table "Whose Video Board Is in Your PC?: A Survey of the Top 25 Systems Vendors."

On PC Labs' VGA tests, the Tseng ET4000 chip set was the clear winner. The only non-ET4000 board that performed well on the hardware tests was the ATI VGAWonder XL, based on ATI's own chip set. The accelerated ATI Graphics Vantage that we previewed is based on the same VGA circuitry in the VGAWonder Plus and VGAWonder XL.

We also tested Western Digital's new controller in a sample 1024 DX board provided by the company; final end-user products were not available in time for testing. The 1024 DX beat out all the reviewed boards in standard VGA and performed respectably with 256 simultaneous colors in both VGA and Super VGA modes under *Microsoft Windows*. It also did well on the VGA hardware tests. (See "From the OEM Front: Western Digital's 1024 CX and 1024 DX.")

Keep in mind that the fastest Super VGA board under *Windows* is always changing. While there is no question that the Desktop Quikdraw VGA and the Video Seven VRAM II are the top performers on our *Windows* tests today, somebody may write a better driver tomorrow to take better advantage of Tseng's Super VGA chip set speed.

THE DRIVER IS THE KEY

Drivers are still the single most important factor in the performance equation. (The Oak study points out that it is the relationship between the Super VGA register and the driver—how well they work together—that is the key.) We illustrated the difference a driver can make in our February 26 article (see "Boosting Video Performance Under Windows 3.0"). A driver that was then still in beta allowed the Video Seven VRAM VGA to zip through our *Windows* performance tests in 41 percent of the time the shipping driver took.

Some video vendors simply slap their names on drivers provided by Microsoft, the video controller maker, or both. Others, such as ATI and Video Seven/Headland, have spent years working on their own drivers. For the end user, it is hard to tell the difference—unless you look at the performance results. The top performers all had enhanced drivers.

To maintain a consistent deadline, we

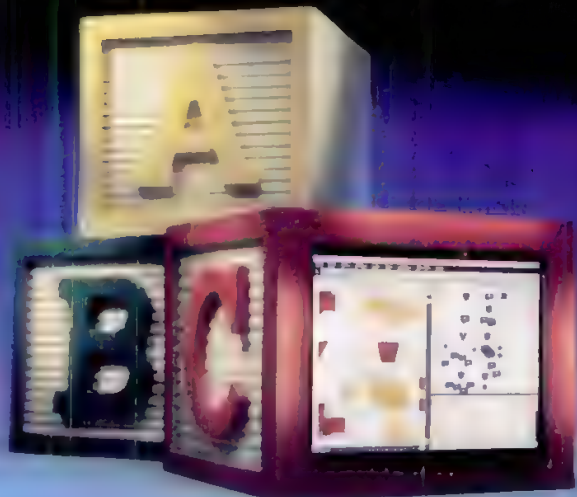
closed our doors to driver updates in early June. (The latest driver date on the features table is May 15, 1991.) Since then, the following vendors have announced enhancements to the *Microsoft Windows* drivers we tested:

- Diamond has released improved 256-color drivers, which it says are twice as fast as the ones we tested.

- Panacea has announced a \$75 software graphics accelerator called *WinSpeed*. Essentially a set of drivers, *WinSpeed* increases performance two to five times in 256-color modes, according to Panacea (603-437-5022). It is designed to work with chip sets from ATI, Trident Microsystems/Xyos, Tseng (ET3000 and ET4000), and Western Digital Imaging/Paradise.

- Tseng will also be shipping new 256-

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CIRCLE 102 ON READER SERVICE CARD

color *Windows* drivers, which are expected to increase performance of Tseng ET4000-based boards between three and five times, depending on the function.

■ Finally, our testing process uncovered a bug in the way the Tseng driver handled unaligned BitBlts in 256-color mode, which Tseng subsequently fixed. In 256-color mode, the time it takes to do both aligned and unaligned BitBlts should be the same, but many of the Tseng chip-based boards produced different results—taking twice as long to perform the unaligned BitBlt test as the aligned one. We confirmed that Tseng's latest driver fixes this problem. Look for drivers with a date later than June 14.

The lesson you should learn from all this late-breaking news on drivers: Don't just look for fast hardware when buying a graphics adapter. The reviews cover driver distribution, and the performance tests show who is doing a good job of writing code. Look for vendors with a BBS and check in several times a year to make sure you have the latest driver.

REGISTER COMPATIBILITY: WHO CARES?

Thanks to *Microsoft Windows*, register compatibility is no longer an issue. Before VGA, most graphics software had been written to manipulate the video controller directly. This required a common register (hardware) standard, which IBM established with VGA. But IBM has yet to support Super VGA, which freed controller vendors to implement resolutions above Super VGA any way they wanted. Most Super VGA controllers had in common only a resolution mode: 800 by 600 pixels. This made it difficult for software vendors to support Super VGA because they had to write for a variety of registers.

Enter *Windows*. Software developers now write to the common environment rather than to a plethora of controllers. And for hardware vendors, supporting *Windows* means that a wealth of applications can take advantage of their Super VGA controllers. And now that VESA has defined a Super VGA BIOS—which all the boards we review here support through hardware, software, or both—compatibility is easier than ever.

HIGH COLOR

Microsoft Windows Super VGA drivers currently support four levels of color: 16, 256, 2,048, and 32,768 colors. To support the last two, vendors are using special

RAMDACs (random-access memory digital-to-analog converters). Edsun's CEG (Continuous Edge Graphics) can theoretically display 792,096 colors, but currently it only supports 2,048 colors under *Windows*. The Sierra HiColor supports 32,768 colors under *Windows*. 13 of the 21 boards we tested offer the Edsun CEG RAMDAC, the Sierra HiColor

RAMDAC, or both. (Check the features table to see which boards offer RAMDACs.)

Before you drool over the possibilities, however, consider the limitations of going beyond 16 colors.

First, there is the question of getting access to them. When you make the jump from 16 to 256 colors, don't expect *Windows* to burst into a rainbow of previously unseen colors. Normally, *Windows* uses



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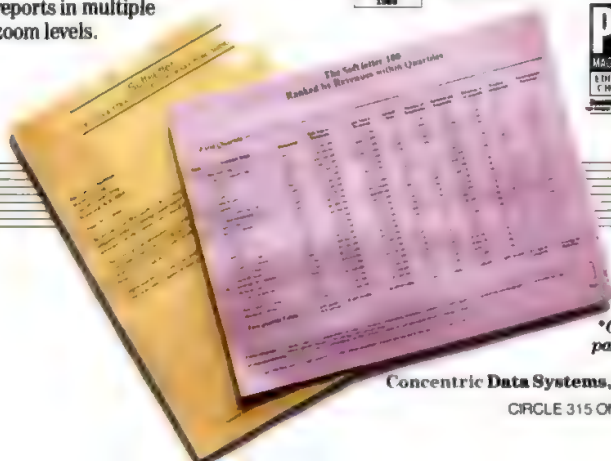
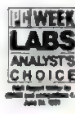
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1 Microsoft Corp.
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Year	Rev. (\$M)	Annual Growth
1990	\$1,447.8	52%
1989	\$952.9	18%
1988	\$719.6	57%
1987	\$456.7	76%

• General business, consumer entertainment, system/environment, programming, communications, networking, publishing, presentations, fonts

2 Lotus Development Corp.
Cambridge, MA
1990 Revenues \$684,500,000
Public Company
1300 Employees

Year	Rev. (\$M)	Annual Growth
1990	\$684.5	23%
1989	\$556.0	14%
1988	\$468.5	16%
1987	\$388.0	40%

• General business, utility/add-on/desk accessory, communications, networking

3 Novell
Provo, UT
1990 Revenues \$510,000,000
Public Company
2425 Employees

Year	Rev. (\$M)	Annual Growth
1990	\$510.0	29%
1989	\$420.0	21%
1988	\$355.0	58%
1987	\$225.0	105%

• General business, system/environment, communications, networking

4 WordPerfect Corp.
Orem, UT
1990 Revenues \$430,259,000
Private Company
2350 Employees

Year	Rev. (\$M)	Annual Growth
1990	\$430.3	6%
1989	\$378.0	14%
1988	\$178.7	28%
1987	\$100.3	92%

• General business, utility/add-on/desk accessory

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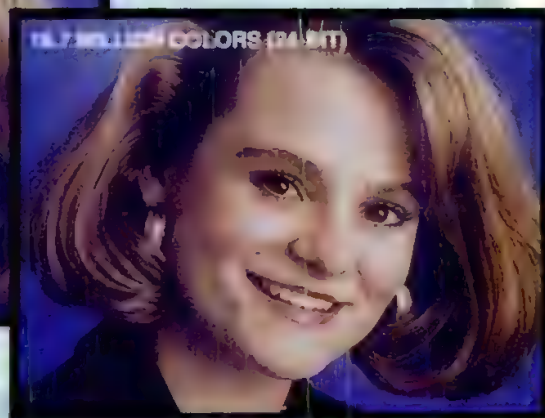
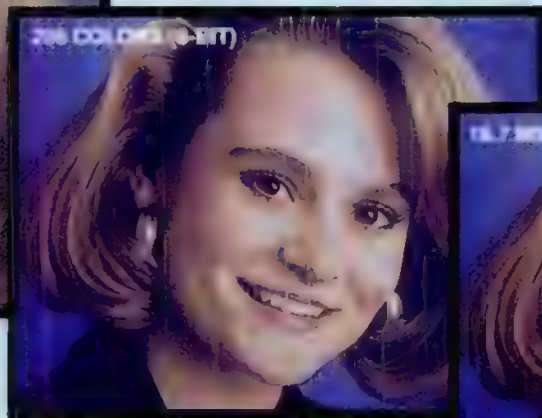
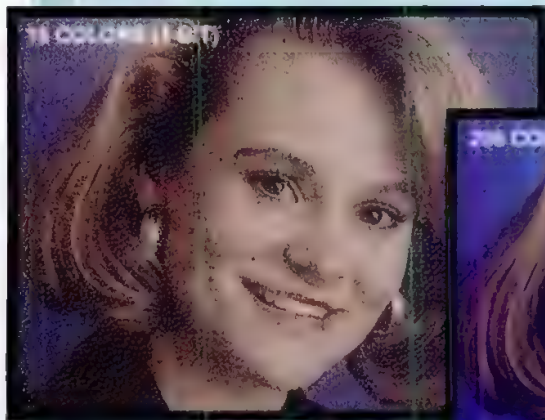
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CIRCLE 315 ON READER SERVICE CARD

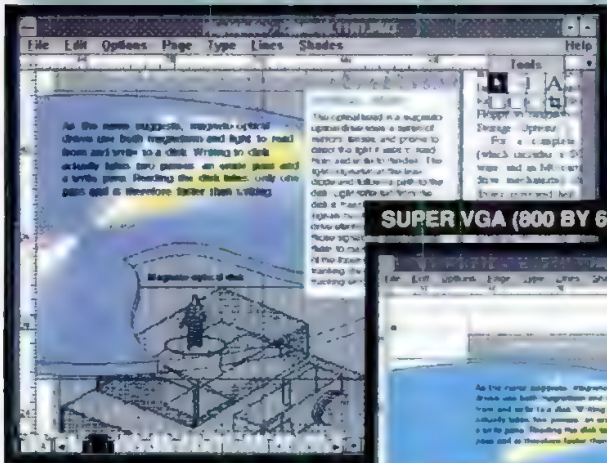
DISPLAY CHOICES: Resolutions and Colors

More Colors = Sharper Images



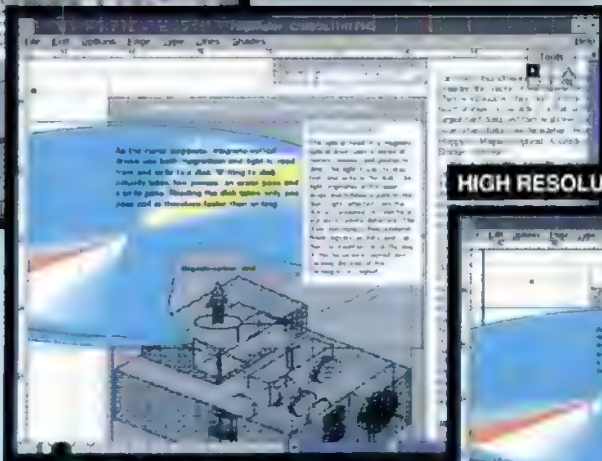
In 16-color mode, our test photo is not acceptable. It looks better in 256-color mode. And with a palette of 16.7 million colors, you get photo-realism that approaches the original.

VGA (640 BY 480)



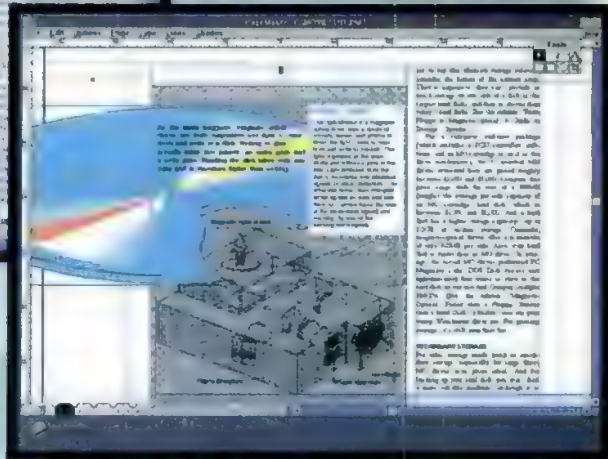
More Pixels = More Information

SUPER VGA (800 BY 600)



In VGA mode, you can see only 60 percent of PC Labs' desktop publishing test page. Super VGA lets you see more. And in high-resolution mode, you can see the whole page.

HIGH RESOLUTION (1,024 BY 768)



HARDWARE

SVGA GRAPHICS ADAPTERS

only 20 of the 256 colors, and these 20 are the only ones you can use for system colors such as menus, title bars, and so forth. The other 236 colors can only be accessed by a *Windows* application that supports the new palette manager facilities of *Windows* 3.0. (See the *Windows* column in the Productivity section of this issue.)

Then there is the performance penalty you will pay. As you add colors, more bits are needed to produce each pixel: In 16-color mode, each pixel requires 4 bits; in 256- and 2,048-color modes, 8 bits; and in 32,768-color mode, 15. From 16 colors to 256, the memory requirement doubles—and it nearly doubles again when you go from 256 colors to 32,768. (Edsun's CEG works a little differently. It encodes the colors in two different palette ranges of 4 bits per pixel each and uses 8 color mixes, for a total of 2,048 colors.) Managing this additional memory in-

creases the burden on the CPU. The boards we tested took 15 to 25 percent longer to run through the *Windows* performance tests in high-color mode than they did with 256 colors. (See "Edsun and Sierra RAMDAC Performance.")

At what point will the resolution and color increases stop? Probably at 1,280-by-1,024 resolution with 24-bit color, which is four times the resolution of VGA. And with 24-bit color, you can display from a palette of 16.7 million colors, which is about all your eyes can see. (For more on 24-bit color, see "The Desktop Rainbow: True Color at 24 Bits" in our June 25 article.) In this mode, 4MB is necessary to display a single screen of information, an amount which fits nicely on a single SIMM. We might see some other displays with higher resolutions, but they will be for specialized applications. And

because they demand larger and more-expensive monitors, higher display modes will be limited in business environments for some time to come.

DISPLAY DECISIONS

It is easy to get lured by marketing hype, but unless you are doing desktop publishing, *AutoCAD*, or serious graphics, you are likely to spend most of your time in standard VGA and Super VGA modes. One limit of the reviewed boards is that they don't offer a larger screen font for high-resolution modes, which is all the more reason you should get a bigger monitor.

For Super VGA, we recommend a diagonal screen size of at least 16 inches, which will cost you roughly \$200 to \$300 more than 13- and 14-inch displays. The \$1,795 Idek MF-5117 and the NEC MultiSync 4D—the price of which just dropped from \$1,499 to \$1,149—took home Editors' Choices in the March 26 article "16-Inch Monitors: Sized for Super VGA." Whatever monitor you choose, be sure it is noninterlaced and supports a 72-Hz vertical refresh rate. For good measure, stick to the new low-emission models like the NEC MultiSync 4DS, also priced at \$1,149. (See "Mainstream Monitors: What Really Matters," July 1991.)

Monitor screens are expected to get flatter over the coming months. Stay tuned for some exciting breakthroughs: Controlling the color on your monitor will be as easy as adjusting the brightness and contrast on your TV set.

NEXT STOP: LOCAL BUS

Since IBM announced XGA, the industry has been asking itself if Super VGA is dead. But local-bus video may show that we haven't seen the last of Super VGA.

Local-bus video means taking the video controller off the 8-MHz external I/O bus and putting it on the 25- or 33-MHz local bus, which the CPU uses to talk to system memory. This strategy would allow video to run three to four times as fast as today's speediest Super VGA graphics adapters. It also means that PC vendors will use video increasingly to differentiate their desktop systems, much in the way that graphics workstation companies such as Sun Microsystems and Hewlett-Packard do now.

The first desktop system to put video on the local bus will be NEC's PowerMate 386SX/20i, which uses Tseng's new ET4000AX Revision F chip set. In the

EDSUN AND SIERRA RAMDAC PERFORMANCE

With their promises of thousands of colors, high-color RAMDACs are alluring. But consider the performance penalty before you dive in.

WHAT THE NUMBERS MEAN

Nine of the Super VGA boards came with a high-color RAMDAC installed, and we tested seven of them in high-color mode. (The ATI VGAWonder XL and the SOTA LightningVGA did not include the necessary drivers for a comparison in Super VGA resolution.)

In the chart below, the **256-Color Cumulative Time** represents the sum of a given board's scores on our *Windows* benchmark tests in Super VGA mode (800-by-600 resolution, 256 colors). The **High-Color Cumulative Time** demonstrates the results achieved when we installed a high-color RAMDAC chip and driver—either Sierra or Edsun—and

retested the board (800-by-600 resolution, with 32,768 colors for Sierra or 792,096 for Edsun).

With one exception, the boards we tested took roughly 16 to 26 percent longer to run through the tests in high-color mode than in 256-color mode. The 512K Genoa SuperVGA 6400VC actually showed improvement in high-color mode, which indicates the inefficiency of its 256-color driver.

The Sierra chip and driver set were a little faster than the Edsun combination, but speed in high-color mode depends as much on the board's design and the underlying *Microsoft Windows* as on the RAMDAC in use. We were able to test the Orchid ProDesigner IIs with both Edsun and Sierra RAMDACs; it produced the best times in the group, with the Sierra RAMDAC supplying the faster performance.

(Lower scores represent better performance)

	256-Color Cumulative Time (milliseconds)	High-Color Cumulative Time (milliseconds)
Genoa SuperVGA 6400VC (Edsun)	4,080.78	2,435.49
Focus 2 the Max VGA 4000 (Sierra)	1,892.07	2,206.46
Cardinal VGA732 (Sierra)	1,854.91	2,172.07
United Ultra-Image HiColor (Sierra)	1,785.49	2,092.19
Diamond SpeedSTAR HiColor VGA (Sierra)	1,790.35	2,090.18
Micro-Labs Ultimate VGA/HiColor (Sierra)	1,804.60	2,089.67
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Orchid ProDesigner IIs (Sierra)	1,553.18	1,840.57

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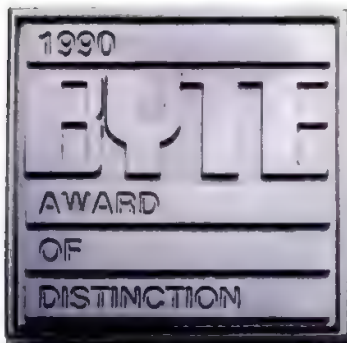
PC Magazine, December 11, 1990



PC World, May 1990



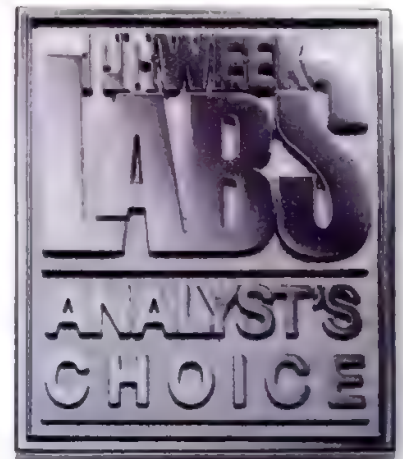
InfoWorld: Product of the Year, February 4, 1991



Byte, January 1991



InfoWorld: Buyers Assurance, January 7, 1991



PC Week, December 24, 1990



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EDITORS' CHOICE

- ATI VGAWonder XL
- Desktop Quikdraw VGA
- Video Seven VRAM II

Video performance consists of two elements: a fast Super VGA controller and a well-honed application driver. The most important is a driver optimized for *Microsoft Windows*. PC Magazine Labs uses two separate test suites to gauge both kinds of performance. Our VGA performance tests measure the controller's raw throughput in a pure DOS environment. And our *Windows* tests measure the controller plus *Windows* driver. So while the VGA tests indicate the hardware's potential, the *Windows* tests show how the boards performed with shipping drivers in the *Windows* environment.

It is performance under *Windows* that matters most. The Super VGA boards that did the best and win an Editors' Choice are the \$399 ATI VGAWonder XL, the \$549 Desktop Quikdraw VGA, and the \$499 Video Seven VRAM II.

On our hardware tests, the stand-out chip set is the Tseng Laboratories ET4000, which deserves special attention. Of the 21 boards we tested, 13 used the Tseng controller. In terms of raw throughput, all of the Tseng-based boards outran the ones based on the other six chip sets we saw. But on our *Windows* tests, none ranked high. They lacked the second half of the equation: good drivers.

Without top performance under *Windows*, none of the Tseng-based boards wins an Editors' Choice. However, as Tseng continues to develop its drivers, these boards could supplant today's top performers. Look for Tseng-based boards that operate at zero wait states and have list prices under \$300. The boards we reviewed that fit this criteria are (in order of affordability) the \$199 United Ultra-Image HiColor, the \$225 Micro Express VGA/72 Hz, the \$245 Boca SuperVGA, the \$299

Diamond SpeedSTAR HiColor VGA, and the \$299 Micro-Labs Ultimate VGA/HiColor.

SPEEDY WINDOWS DRIVERS

The other chip set that fared well on our tests was the ATI controller in the ATI VGAWonder XL. The board also did well on our *Windows* tests, coming in third and fourth on almost every test. It was particularly solid in the 16-color modes, and at \$399, the adapter is reasonably priced.

Although the Desktop Quikdraw VGA (which uses a Chips and Technologies chip set) and the Video Seven VRAM II (which uses a Video Seven/Headland chip set) did not shine on our VGA hardware tests, they were the top performers under *Windows*. Clearly, their drivers were better optimized for *Windows* than those of their competitors at the time of our testing. To get the performance they offer, you will have to pay a price. Using comparatively pricey VRAM, these two boards are the most expensive in this roundup.

Watch this fall for boards with graphics accelerators. They have *Windows* functions (such as BitBlt, line drawing, and area filling) in hardware. ATI's 1MB \$599 Graphics Vantage, which we previewed, looks very promising. Because it was not shipping when we tested it, the ATI Graphics Vantage was not eligible for an Editors' Choice. We were also very impressed by a sample board from S3 (pronounced "S cubed"), which had its new accelerated single-chip 86C911 controller on-board. It too was not eligible for Editors' Choice consideration because it was not an end-user product. Soon Elite Microelectronics and OPTi will deliver 86C911-based products.

Finally, for the ultimate in fast video, see our review of 15 coprocessed boards in the June 25, 1991, article "1,024-by-768 Coprocessed Graphics Adapters: High Resolution and High Speed."

coming months we expect to see several other video controllers with local-bus implementations on system boards.

As *Windows* functions start to show up in Super VGA controllers, and those controllers move to the system board with access to the local bus, it is clear that Super VGA still has plenty of life left. With better drivers and *Windows* 3.1 on the way, the future looks even brighter. And until then, the 21 Super VGA boards in this roundup promise to make your life with *Windows* a lot smoother.

AHEAD SYSTEMS INC.

Ahead VGA Wizard/
Deluxe 5.0

by Oliver Rist

Ahead Systems, a five-year-old California-based chip manufacturer, has taken the second revision of its display chip set (introduced in 1988) and placed it on its own board. The 16-bit Ahead VGA Wizard/Deluxe 5.0 retails for only \$139—the cheapest list price of any board in our roundup. Unfortunately, the minimal price buys you only minimal performance and basic features.

Along with an incredible price, the board provides support for all higher resolutions except 1,280 by 1,024. It supports Super VGA resolution in 256-color mode at only a 56-Hz vertical refresh rate, and you can get 256 colors at 1,024-by-768 resolution only in interlaced mode. There are 72-Hz ergonomic modes for 16-color 800-by-600 resolution and 256-color 640-by-480 resolution.

Although not the worst-performing graphics board in this roundup, the VGA Wizard/Deluxe did finish in the bottom five on almost every one of our performance tests; its scores on the *Microsoft Windows* and VGA tests consistently trailed the group—except for BitBlt in 16-color VGA.

The rest of the package is equally elementary. Ahead Systems' documentation is skimpy and definitely not for the novice. Fortunately, the initial setup procedure and the card's default settings are intuitive enough for you to make installation mostly headache-free, and there is a healthy selection of bundled software drivers as well (including drivers for 8514/A AI and AutoCAD).

The most attractive feature of the Ahead



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CIRCLE 387 ON READER SERVICE CARD

HARDWARE

SVGA GRAPHICS ADAPTERS

VGA Wizard/Deluxe 5.0 is certainly its price, but if you can afford a board with a higher price tag, you can find a board that can do substantially better on performance and features.

Ahead VGA Wizard/Deluxe 5.0

Ahead Systems Inc., 44244 Fremont Blvd., Fremont, CA 94538; 415-623-0900. **List Price:** With 1MB DRAM, \$139. **In Short:** The VGA Wizard/Deluxe 5.0's rock-bottom price comes at the expense of performance. The board does not include such desirables as a 72-Hz vertical refresh rate in 256-color Super VGA mode.

CIRCLE 618 ON READER SERVICE CARD

ATI TECHNOLOGIES INC.

ATI VGA Integra

by Alfred Poor

It just does not make sense to buy a plain-vanilla VGA display adapter anymore. Not when there are cards like the VGA Integra from ATI Technologies. ATI is well known for its hot-rod high-resolution adapters, but this little gem comes with an equally small list price of \$189—all the more attractive because ATI products are frequently available at discounted prices.

Based on ATI's own proprietary chip set and designs, the VGA Integra is as small as its price, just barely longer than its ISA-bus 16-bit edge connector and only about half as tall as the standard expansion card bracket, which carries the 15-pin video cable connector. Unlike some of the other cards included in this review, this adapter still makes room for a VGA pass-through connector at the top of the board—a feature required by many add-on high-resolution display adapters that do not provide their own VGA support.

You are not likely to need any other adapters, however, if you start with the VGA Integra. It provides 256-color support at 800-by-600 resolution and a 16-color 1,024-by-768 noninterlaced mode. Part of the reason for its low cost is the VGA Integra's ability to manage these high resolutions with just 512K of on-board memory.

Another reason for the lower price is that the card does not sport as sophisticated a design as some of its competitors. While it supports a 72-Hz vertical refresh rate for VGA and 16-color 800-by-600 modes, it can only manage 70 Hz when displaying 256 colors at 800-by-600 reso-

lution. And for the 16-color 1,024-by-768 noninterlaced mode, it only offers a 60-Hz vertical refresh rate.

The VGA Integra also failed to keep pace with the fastest of the competition on most of PC Magazine Labs' benchmark tests. While most of its times fell somewhere in the second half of the pack, the card came in last on all but two of the 256-color 800-by-600 *Microsoft Windows* tests. It did, however, excel at BitBlts in standard 16-color VGA mode, finishing in the top five for that test and indicating strong *Windows* graphics capabilities.

The low price does not come at the expense of support features, however. The documentation is exemplary, installation is a breeze, and ATI offers free technical support through phone, fax, and an elec-



The VGA Integra can manage high resolutions with just 512K of on-board RAM.

tronic bulletin board system.

If budget constraints rank high on your list of decision criteria, or if you are simply buying a VGA system now but want the option of higher resolutions later without having to change cards, the VGA Integra is an excellent choice; other cards may be faster, but few offer such high resolutions at such an attractive price.

ATI GRAPHICS VANTAGE: Coproprocessed Speed, Frame-Buffer Price

by Alfred Poor

Graphics accelerators, which contain specific *Microsoft Windows* functions such as BitBlts, line filling, and area drawing, are an emerging category of video controllers. (The difference between an accelerator and a coprocessor is that the former is fixed in its functionality, whereas the latter is programmable.) IBM's XGA is probably the best-known accelerator.

Although several companies have announced accelerators, ATI Technologies Inc. was the only one to produce an end-user product in time for testing (416-756-0718). The 1MB \$599 Graphics Vantage was still in beta, so we were unable to include it in the reviews even though it met our criteria. (The 512K version is priced at \$499.)

The beta unit performed exceptionally well. On our *Windows* tests in 800-by-600 mode with 256 colors, it beat every other board we have tested this year—including boards that use coprocessors in this mode, such as the Appian Rendition II and the Hercules Graphics Station Card GB1024+2. (See the chart "Windows Performance Snapshot.") On the BitBlt *Windows* tests in this mode, it was two to five

times as fast as the speediest competitor. On most of the other *Windows* tests, the ATI Graphics Vantage was more than four times as fast as the quickest board, and in one case it accomplished a test in one-fifth the time it took the fastest adapter.

Where does the ATI Graphics Vantage get its blinding speed? It uses an ATI Mach 8 chip (an 8514/A compatible design) with *Windows* drivers tuned to take full advantage of the chip's capabilities. The board also carries ATI's VGAWonder Plus circuitry for VGA compatibility.

By using cheaper DRAM instead of VRAM, ATI was able to keep costs down without cutting corners. The card is capable of a 72-Hz vertical refresh rate, even at 1,024-by-768 noninterlaced resolutions. ATI also includes its Crystal Fonts support, which uses anti-aliasing techniques to smooth the jaggies from on-screen fonts. There is even a mouse port on the card, and ATI includes a mouse with the package. The card has a 16-bit ISA design and can work in either an 8-bit or 16-bit slot. If ATI can deliver on the promise this preproduction model has shown, the Graphics Vantage will be a spectacular value. ■

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more important than
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A man and a woman are on a boat. The man, wearing glasses and a dark polo shirt, stands behind the woman. The woman, also wearing glasses and a white patterned shirt, is seated and looking out at the water. The background shows a blue sky and a body of water.

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Vince Chrisman, Borg Warner, Detroit

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Seven years ago, Karl Melter built his own computers from kits. But when the kit companies dropped their customer support, he began to look elsewhere. Melter, a Chicago mechanical engineer, knew what he wanted. And he found it at CompuAdd. "In the store," he recalls, "there was a cutaway CompuAdd computer, so I could see how well it was made. I said, 'That's the computer I'm going to buy.'" Since then, he's been just as pleased with CompuAdd service. Melter had a motherboard replaced, and he upgraded his system memory. All at his local store. "They're very helpful," he says. "I like the people there."

Karl Melter, Mechanical Engineer, Chicago



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When Jim Edwins of Jade Tree Travel in Minneapolis bought a CompuAdd computer and a modem for a branch office in Arizona, he planned on long distance computing. What he didn't plan on was long distance technical help. But after his agent took the system to Arizona, the modem didn't work. CompuAdd stores in Tempe and Minneapolis teamed up to help Edwins discover the problem — his software. "With several technicians on the line, we got back in touch," he recalls. "A travel agent without a computer — you just can't do it. But the people at CompuAdd really bent over backward, and I commend them for that."

Jim Edwins, Jade Tree Travel, Minneapolis



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ATI VGA Integra

ATI Technologies Inc., 3761 Victoria Park, Scarborough, Ontario, Canada M1W 3S2; 416-756-0718. **List Price:** With 512K DRAM, \$189. **In Short:** The VGA Integra trades performance speed for an extremely attractive price.

CIRCLE 619 ON READER SERVICE CARD

ATI TECHNOLOGIES INC.**ATI VGAWonder XL**

by Alfred Poor

A reasonable price, good performance, solid support, and a raft of extra features make the VGAWonder XL from ATI Technologies an appealing high-resolution candidate. With list prices of \$299 for the 512K version and \$399 for the 1MB configuration, the card presents an affordable alternative.

This is not a stripped-down model, either. Based on ATI's own chip set and design, the board (6.2 inches long) makes room for both a 15-pin analog and a 9-pin digital video connector, a DIN mouse port (with a three-button mouse included at no extra cost), and a VGA pass-through edge connector along the top of the card—used with add-on adapters that don't provide their own VGA support.

Noticeably missing from the card's layout are switches. Installation is a snap, thanks to configuration software that programs the card's on-board EEPROM to work with your monitor and to set other options such as the vertical refresh rates or mouse operation. The accompanying manual does a good job of explaining the card's options.

The 256K version of the VGAWonder XL gives you 16 colors in 800-by-600 and VGA resolutions, plus four colors at 1,024 by 768. Sockets on the card allow you to upgrade it to either 512K or 1MB of memory. With full memory installed, you can get up to 256-color support at 800-by-600 and 1,024-by-768 resolutions and 32,768 colors in VGA mode. If you have 1MB of memory, you can also get a 72-Hz vertical refresh rate at all three resolutions.

In terms of performance, the VGAWonder XL was not the fastest but was generally near the front of the pack. It beat the competition on the Screen-to-Screen BitBlt performance test as well as six of the VGA-resolution *Windows* tests in 16-color and 256-color modes. It did not fare

quite as well on the 800-by-600-mode *Windows* tests, but except for the 256-color Dialog Boxes Show and Destroy test, it was competitive in its speed.

The ATI VGAWonder XL offers a lot for its price. You get good performance, a wide range of features, and a few bonuses such as 32,768 colors and a bus mouse. ATI's attention to its drivers has clearly paid off, making the VGA Wonder XL an attractive value.

EDITORS' CHOICE**ATI VGAWonder XL**

ATI Technologies Inc., 3761 Victoria Park, Scarborough, Ontario, Canada M1W 3S2; 416-756-0718. **List Price:** With 1MB DRAM and Sierra RAMDAC, \$399. **In Short:** The feature-laden VGAWonder XL is a competitive performer with an attractively low price and well-written drivers.

CIRCLE 620 ON READER SERVICE CARD

BOCA RESEARCH INC.**Boca SuperVGA**

by Alfred Poor

With a list price of just \$175 for the basic 256K configuration, the Boca SuperVGA from Boca Research offers an attractive value among its competition. Some shortcomings offset its low price, but the card still holds up well.

Based on the Tseng Laboratories chip set, the Boca SuperVGA also comes in two other memory configurations (or you can add your own chips to the base-priced model). The 512K version has a list price of \$195, and the full 1MB configuration costs \$245. You will need the full amount of memory to take advantage of all the board's display modes.

The card can simultaneously display up to 256 colors in VGA, 800-by-600, and even noninterlaced 1,024-by-768 mode. The best it can do in the 1,024-by-768 modes is a 60-Hz vertical refresh rate, but it can provide up to 72 Hz in either the VGA or 800-by-600 modes.

Installation and setup was fairly easy, though there were some snags. The documentation is Spartan: a small stapled booklet filled with few illustrations and lots of dense type in a small font. Unlike many of the other cards that use the generic SETUP procedure for modifying *Microsoft Windows* 3.0, the Boca Super-

VGA requires special versions of some of these files; although not a major problem, it is a bit more of a nuisance than the procedures used by most other cards.

The card also does not have a VGA pass-through edge connector. There is a dual-pin connector for this purpose on the card, but it requires a special cable.

The Boca SuperVGA did turn in acceptable performance times. In many cases, the results were in the second half of the field, but the card was more competitive in the 800-by-600 results, especially the 256-color version of the tests. We also tested this board in high-resolution modes, where it proved slower than the VRAM-based Video Seven VRAM II.

The Boca SuperVGA's documentation and installation procedures may not be optimal, and its performance results are not the fastest, but these factors are good enough that they should not pose any problems. Add in the low list price and you get a card that is worth consideration by the budget-minded buyer.

Boca SuperVGA

Boca Research Inc., 6413 Congress Ave., Boca Raton, FL 33487; 407-997-6227. **List Price:** With 1MB DRAM, \$245. **In Short:** Though a bit weak in terms of installation and documentation, the Boca SuperVGA offers a low list price and performance figures good enough to make it worth a look if your funds are limited.

CIRCLE 621 ON READER SERVICE CARD

CARDINAL TECHNOLOGIES INC.**Cardinal VGA732**

by John R. Quain

Cardinal Technologies' VGA adapter is a response to critics who complained the company's VGA700 was too much money for too few frills. At \$239—and with expected dealer discounts of 20 percent—the VGA732 is competitively priced for an adapter with 1MB of DRAM, the ubiquitous Tseng Laboratories ET4000 chip set, and a surface-mounted Sierra HiColor RAMDAC that delivers 32,768 colors in Super VGA mode with a 72-Hz vertical refresh rate. However, with other manufacturers continually upping the ante, the real question is whether Cardinal's slightly above-average performance is fast enough to travel with the below-\$300 crowd.

The VGA732 analog-only adapter is

compatible with applications written for outdated EGA, CGA, MDA, or Hercules graphics standards. It also includes utilities for 8514/A emulation and BIOS acceleration, which uses a 32K TSR to copy the video BIOS into system RAM to improve speed (we ran the VGA732 through our benchmark tests without this feature). Supplied drivers cover the major DTP and CAD packages, including a display-list driver for improved *AutoCAD* performance. (Cardinal offers a BBS for updated drivers and additions.) The board achieves VESA compliance via a TSR that requires about 3K of memory. If you want to go beyond that, the VGA 732—in addition to the extra Sierra colors—will deliver 256 colors in noninterlaced 1,024-by-768 mode with a 60-Hz vertical refresh rate and can be pushed out to 1,280 by 1,024 pixels with an 87-Hz vertical refresh rate in interlaced mode.

The VGA732 needs a few finishing touches, but the rough spots we encountered during testing were minor. The automatic menu-driven software installation, for example, was not quite automatic: It would not work with DOS 4.01's SHARE installed. But removing the command from the AUTOEXEC.BAT file is simple enough, and once the driver installation is complete, you can reinstall SHARE. According to the company, a new release that circumvents this problem should be available by the time you read this review.

In the 256-color Super VGA *Microsoft Windows* performance arena, the VGA732 did better than average in all but two of PC Magazine Labs' performance tests. Dropping the palette requirements down to 16 colors in Super VGA cut the distance between this board and others in its class, reducing Cardinal's performance to merely average. The board performed similarly in VGA *Windows* modes, but results using Sierra's high-color driver were rather slow.

Although the VGA732 is a zero-wait-state board, its performance on the VGA tests was on par with one-wait-state boards. Cardinal declined to explain this but claims to have fixed the problem.

The Cardinal VGA732 is a reliable albeit slow high-color compromise.

Cardinal VGA732

Cardinal Technologies Inc., 1827 Freedom Rd., Lancaster, PA 17601; 800-233-0187, 717-293-3000. **List Price:** With 1MB DRAM and Sierra RAMDAC, \$239. **In Short:** An above-average board in Super VGA 256-color

mode at a 72-Hz vertical refresh rate, the additional bonus of the Sierra RAMDAC and Cardinal's reduced price may entice those looking for reliability and more color.

CIRCLE 622 ON READER SERVICE CARD

DESKTOP ELECTRONICS *Desktop* *Quikdraw VGA*

by Alfred Poor

One of the great aspects of the microcomputer industry is that big news comes from relatively unknown companies. The Quikdraw VGA from Desktop Electronics is a perfect example; with a list price of \$549 with 1MB of VRAM, this board excels when displaying high-resolution *Microsoft Windows* images.

While Desktop Electronics may not be a household word for *PC Magazine* readers, the maker of the board's chip set is Chips and Technologies. In fact, the entire board was designed by Chips and Technologies. But the company does not actually build the boards; Desktop Electronics does. Chips and Technologies licenses the total design in a turnkey package so that client companies can set up their own manufacturing, which is exactly what Desktop Electronics has done.

The board is fairly straightforward, with just a 15-pin video connector, a few sets of jumper pins, and a VGA pass-through edge connector along the top. There are no switches, and the factory defaults for the jumper settings will work for most installations.

With the full 1MB of memory, the board can produce as many as 256 colors in VGA, 800-by-600, or even 1,024-by-768 (interlaced and noninterlaced) resolutions. The board is able to produce 72-Hz vertical refresh rates for VGA and 800-by-600 resolution modes but not the 1,024-by-768 mode.

Once you have the board installed and *Windows* 3.0 running with the Quikdraw VGA drivers, you see the card's power. Its test results for VGA resolutions are good, but at 800 by 600 (either 16 or 256 colors), the Quikdraw VGA's performance is outstanding. In 16-color mode, it was the fastest in seven of the nine tests and six out of nine in the 256-color mode.

There are a few weak points: The manual is not as informative about the various display modes as it could be, and there are paper labels glued to the card where other companies would silk screen the information onto the circuit board itself. These are minor points, though.

The overriding fact is that the Desktop Quikdraw VGA is one fast board. It's priced near the top of the field, but if you are looking to get top performance for an 800-by-600 72-Hz 256-color display under *Windows*, you need look no further.

EDITORS' CHOICE

Desktop Quikdraw VGA

Desktop Electronics, 1630 Oakland Rd., #A-203, San Jose, CA 95131; 408-441-0626. **List Price:** With 1MB VRAM, \$549. **In Short:** The Quikdraw VGA is more expensive than most of the other cards, but at 800-by-600 resolution under *Microsoft Windows*, it is also one of the fastest.

CIRCLE 623 ON READER SERVICE CARD

DIAMOND COMPUTER SYSTEMS INC.

Diamond SpeedSTAR *HiColor VGA*

by Kellyn Betts

Diamond Computer Systems' \$299 SpeedSTAR HiColor is descended from one of the most respected graphics-board blood lines in the industry. And though this thoroughbred was not the overall winner in our roundup, it finished respectably enough to make it a good value.

PC Magazine Labs' VGA performance tests proved to be the best race-track for the SpeedSTAR HiColor. But even though it did win first-place honors here, its lead was not as great as we might have expected; it beat the others only by a nose. And while its Tseng Laboratories-based chip set held its own on our *Windows* performance tests, we can only describe its scores as consistently average. (As we went to press, Diamond released new drivers, which are expected to improve performance in 256-color modes.)

In addition to the board we tested, Diamond's line now includes three other cards. The SpeedSTAR HiColor model we reviewed is identical to the \$289 SpeedSTAR Plus, except that the lower-priced card's DAC is traded up for a socket-mounted Sierra HiColor DAC.

The 32,768 colors the SpeedSTAR

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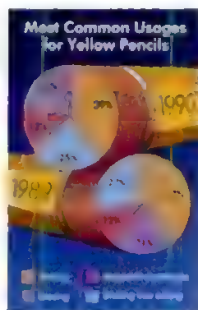
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HARDWARE

SVGA GRAPHICS ADAPTERS

HiColor board can display make its target audience CAD and desktop presentation aficionados. Diamond says the board is Targa-file compatible without conversion, and it comes with an ADI for *AutoShade* supporting high color, as well as a proprietary *AutoCAD* display-list driver.

Users will be glad for its easy setup and good documentation. To top it off, the company includes a five-year warranty, a technical support line, and a bulletin-board service.

Because of Diamond's large market share, its graphics adapters are solid buys in terms of features and price. The SpeedSTAR HiColor VGA's performance, though average, was fast enough to keep most *Windows* users satisfied and make this card worth considering. Go for the

less-expensive straight DAC version unless you need 16-bit color or extremely legible text. With a low list price and zero-wait-state operation, it stacks up favorably against other Tseng-based boards.

Diamond SpeedSTAR HiColor VGA Diamond Computer Systems Inc., 532 Mercury Dr., Sunnyvale, CA 94086; 408-736-2000. **List Price:** With 1MB DRAM and Sierra RAMDAC, \$299; without Sierra RAMDAC, \$289. **In Short:** The SpeedSTAR HiColor VGA turned in respectable performance-test results, has a solid features array, and is backed by a well-known graphics card manufacturer.

CIRCLE 624 ON READER SERVICE CARD

EVEREX SYSTEMS INC.

Everex VRAM VGA

by Winn L. Rosch

Everex Systems has positioned its VRAM VGA somewhere in the middle of its product line. Carrying a middling price tag of \$499 with 1MB of DRAM, it squeezes in next to the \$98 Viewpoint Standard (a VGA board capable of 800-by-600 resolution) and the \$219 Viewpoint NI (1,024-by-768 noninterlaced with VESA compatibility stored in ROM), but well below the more expensive boards that carry more colors and VRAM performance: the \$795 Viewpoint TC (with a 32,768-color palette), the \$849 Vision VGA HC (32,768 colors and a NTSC

SUPER VGA GRAPHICS ADAPTERS: SUMMARY OF FEATURES

Products listed in alphabetical order

We tested the 21 Super VGA boards with the maximum available display memory installed: 1MB for all but the ATI VGA Integra and Genoa SuperVGA 6400VC, which have a 512K maximum. All the boards used DRAM except the Desktop Quikdraw VGA and the Video Seven VRAM II, both of which used VRAM. Most of the vendors now offer a high-color RAMDAC option (Edsun CEG, Sierra HiColor, or both), but only nine were able to provide us with RAMDAC-installed boards in time for testing.

	Ahead VGA Wizard/Deluxe 5.0	ATI VGA Integra	ATI VGAWonder XL
List price (tested configuration)	\$139	\$189	\$399
Size (L x H, in inches)	6.75 x 4.25	6.25 x 3	6.25 x 4.25
VGA SUPPORT			
Video BIOS manufacturer	Ahead	ATI	ATI
Version number	1.02	1.1	0.1
Date	4/2/91	11/14/90	5/2/91
VESA compliance	TSR	TSR	TSR
VGA chip set manufacturer	Ahead	ATI	ATI
Display memory	1MB	512K	1MB
Type installed	DRAM	DRAM	DRAM
Minimum available	256K	512K	256K
DISPLAY CHARACTERISTICS			
Maximum addressable resolution (pixels)	2,048 x 1,024	1,024 x 768	1,024 x 768
Maximum displayable resolution (pixels)	1,024 x 768	1,024 x 768	1,024 x 768
Maximum displayable text (columns by rows)	132 x 44	132 x 44	132 x 44
High-color RAMDAC installed	None	None	Sierra
Other high-color RAMDAC available	None	None	None
Number of colors simultaneously displayable at 800 x 600 pixels	256	256	256
VIDEO STANDARDS			
1,280 x 1,024	☐	☐	☐
1,024 x 768 (noninterlaced)	☒	☒	☒
1,024 x 768 (interlaced)	☒	☒	☒
800 x 600 (Super VGA)	☒	☒	☒
640 x 480 (VGA)	☒	☒	☒
SOFTWARE DRIVERS			
AutoCAD	☒	☒	☒
GEM	☒	☒	☒
Lotus 1-2-3	☒	☒	☒
Microsoft Windows 3.0	☒	☒	☒
Presentation Manager	☒	☒	☒
Ventura Publisher	☒	☒	☒

 — Editors' Choice

☒ — Yes

☐ — No

HARDWARE SVGA GRAPHICS ADAPTERS

video output), and the \$689 Vision VGA with Overlay (which lacks 32,768-color support but allows computer graphics to be overlaid on NTSC video). While the VRAM VGA's overall performance is satisfactory, its abilities in 256-color modes might make you think twice before buying it.

The 9.5-inch-long, XT-height board replaces Everex's old Viewpoint by eliminating interlacing at its two highest resolution modes (800 by 600 and 1,024 by 768) and putting VESA support in its proprietary ROM BIOS. At all resolution levels, 256 on-screen colors are available from a palette of 262,144.

One black mark the VRAM VGA deserves is its requirement of running one of two 842-byte programs to select 60- or

72-Hz vertical refresh rates at 800- by 600-pixel resolution (the default is the 56-Hz VESA guideline frequency). An upgrade to the VRAM VGA's Everex ROM, which was not in final form at the time of this evaluation, will reportedly include the needed code in its firmware.

The Everex VRAM VGA relies on Tseng Laboratories' ET4000AX chip for most of its circuitry and uses a standard VGA RAMDAC (a Sierra 481 on the evaluation sample) to create the analog-only output supplied to its 15-pin, high-density D-shell jack. A VGA feature connector is available for expansion.

Either ZIP-style VRAM chips or DIP-style DRAM chips will fit the Everex

VRAM VGA's eight dual-purpose sockets. The factory-equipped 1MB product came with DRAM chips rated at 80 nanoseconds.

In general, the Everex VRAM VGA's performance scores fell in the middle of the group on PC Magazine Labs' *Windows* performance tests, but it plummets to near-bottom in the 256-color-mode tests, often scoring in the bottom five. The board is at its best in handling the *Windows* user interface (dialog-box drawing and rectangle clipping), scoring as high as fourth even in 256-color mode at 800- by 600-pixel resolution. That makes it a choice for jockeying through *Windows* rather than drawing graphics.

Installation and setup of the Everex VRAM VGA are straightforward. A six-

Boca SuperVGA	Cardinal VGA732	Desktop Quikdraw VGA	Diamond SpeedSTAR HiColor VGA	Everex VRAM VGA	Focus 2 the Max VGA 4000	Genoa SuperVGA 6400VC
\$245	\$239	\$549	\$299	\$499	\$220	\$229
7.75 x 4.25	8 x 3.75	7.5 x 4.25	6.25 x 4.25	9.5 x 3.75	8.5 x 4	8 x 4
Boca 2.00 3/15/91 TSR Tseng 1MB DRAM 256K	Tseng 2.0 4/26/91 TSR Tseng 1MB DRAM 1MB	C&T 1.0 5/1/91 BIOS C&T 1MB VRAM 512K	Diamond 4.23 3/1/91 TSR Tseng 1MB DRAM 512K	Everex 1.01 12/13/90 BIOS Tseng 1MB DRAM 512K	Focus 2.01 4/29/91 EPROM Tseng 1MB DRAM 256K	Award/Genoa 3.70 4/15/91 BIOS Genoa 512K DRAM 256K
1,024 x 768 1,024 x 768 132 x 60	1,280 x 1,024 1,280 x 1,024 132 x 60	1,024 x 768 1,024 x 768 132 x 50	1,024 x 768 1,024 x 768 132 x 44	1,280 x 1,024 1,280 x 1,024 132 x 31	1,280 x 1,024 1,280 x 1,024 132 x 60	1,024 x 768 1,024 x 768 132 x 60
None None 256	Sierra None 32,768	None None 256	Sierra Edsun 32,768	None None 256	Sierra Edsun 32,768	Edsun None 792,096
□ ■ ■ ■ ■	□ ■ ■ ■ ■	□ ■ ■ ■ ■	□ ■ ■ ■ ■	■ ■ ■ ■ ■	□ ■ ■ ■ ■	□ ■ ■ ■ ■
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CONTINUES

HARDWARE

SVGA GRAPHICS ADAPTERS

The Everex VRAM
VGA's performance
scores fell in the
middle of the group.

bank DIP switch is accessible through the card's retaining bracket to select monitor type, bus width (auto-select or force eight-bit operation) for RAM and ROM, and the address range used by the on-board ROM. Everex supplies all important drivers with the board or makes them available via the

company's electronic bulletin board. Only *AutoCAD* display-list drivers cost extra (\$99 for a Panacea driver, \$199 for Lightning Zoom). For your peace of mind, the Everex VRAM VGA is backed by a two-year warranty and a business-hours-only technical hot line.

If you do not need too many colors on the screen and you're not too keen about paying for the most expensive Super VGA board, you might give the Everex VRAM VGA a fleeting look; otherwise, you can find better performance elsewhere.

Everex VRAM VGA

Everex Systems Inc., 48431 Milmont Dr., Fremont, CA 94538; 800-821-0806.

List Price: With 1MB DRAM, \$499; with

Sierra RAMDAC (Viewpoint Premium VGA), \$339. **In Short:** A moderately expensive VESA-compliant Super VGA board that lags in 256-color performance, the VRAM VGA delivers all the expected standard features.

CIRCLE 625 ON READER SERVICE CARD

**FOCUS INFORMATION
SYSTEMS INC.****Focus 2 the Max
VGA 4000**

by Bill O'Brien

The goal behind using an enhanced RAMDAC is to provide extended video capabilities without requiring you to take

SUPER VGA GRAPHICS ADAPTERS: SUMMARY OF FEATURES

Products listed in alphabetical order

	Micro Express VGA/72 Hz	Micro-Labs Ultimate VGA/HiColor	Orchid ProDesigner IIs	PCGC Photon Ultima Turbo	Prism Excelsior	SigmaVGA Legend
List price (tested configuration)	\$225	\$299	\$449	\$445	\$495	\$359
Size (L x H, in inches)	7.75 x 4.25	7.75 x 4	8.25 x 3.75	9 x 4.25	8 x 4	7 x 4.25
VGA SUPPORT						
Video BIOS manufacturer	Micro Express	Tseng	Orchid	Photon	Prism	Sigma
Version number	5E	8.00	1.0	3.3	1.15	2.81
Date	5/15/91	4/28/91	4/9/91	1990	4/22/91	9/20/90
VESA compliance	TSR	TSR	TSR	TSR	TSR	TSR
VGA chip set manufacturer	Tseng	Tseng	Tseng	Trident	Tseng	Tseng
Display memory	1MB	1MB	1MB	1MB	1MB	1MB
Type installed	DRAM	DRAM	DRAM	DRAM	DRAM	DRAM
Minimum available	1MB	256K	512K	256K	1MB	512K

DISPLAY CHARACTERISTICS

Maximum addressable resolution (pixels)	1,024 x 768	1,280 x 1,024	1,024 x 768	1,280 x 820	1,600 x 1,024	1,024 x 768
Maximum displayable resolution (pixels)	1,024 x 768	1,024 x 768	1,024 x 768	1,280 x 820	1,600 x 1,024	1,024 x 768
Maximum displayable text (columns by rows)	132 x 44	132 x 60	132 x 44	132 x 60	132 x 44	132 x 44
High-color RAMDAC installed	None	Sierra	Sierra	None	None	None
Other high-color RAMDAC available	None	Edsun	Edsun	Edsun	Sierra	None
Number of colors simultaneously displayable at 800 x 600 pixels	256	32,768	32,768	256	256	256

VIDEO STANDARDS

1,280 x 1,024	☐	☒	☐	☒	☒	☐
1,024 x 768 (noninterlaced)	☒	☒	☒	☒	☒	☒
1,024 x 768 (interlaced)	☒	☒	☒	☒	☒	☒
800 x 600 (Super VGA)	☒	☒	☒	☒	☒	☒
640 x 480 (VGA)	☒	☒	☒	☒	☒	☒

SOFTWARE DRIVERS

<i>AutoCAD</i>	☒	☒	☒	☒	☒	☒
<i>GEM</i>	☒	☒	☒	☒	☒	☒
<i>Lotus 1-2-3</i>	☒	☒	☒	☒	☒	☒
<i>Microsoft Windows 3.0</i>	☒	☒	☒	☒	☒	☒
<i>Presentation Manager</i>	☐	☐	☒	☒	☒	☒
<i>Ventura Publisher</i>	☒	☒	☒	☒	☒	☒

 — Editors' Choice

☒ — Yes

☐ — No

HARDWARE
SVGA GRAPHICS ADAPTERS

out a second mortgage. The Focus 2 the Max VGA 4000 satisfies that requisite. Although the board's performance is mostly average, Focus's quoted \$220 price for its 1MB of DRAM, Tseng Laboratories chip set, 72-Hz Super VGA compatibility, and Sierra RAMDAC will certainly get your attention.

Focus supplies a long list of video drivers that include *AutoCAD* 9 and 10; *GEM* 3.x; *Lotus 1-2-3*, Release 2; *Microsoft Windows*, Versions 2.x and 3.0; *Ventura Publisher*, Versions 1.1 and 2.0; *WordPerfect* 5.0 and 5.1; and even *SCO Xenix System V*. What they fail to provide is any cogent method of installation. Two disks contain all the drivers (each driver is in its own subdirectory), and there is a third disk with utilities. The Focus 2 the

Max manual is meticulous in describing the steps you need to install them correctly, which is quite a help because you have to do it all manually.

You are in for some surprises when you do install the card. Under DOS, the Focus 2 the Max is absolutely unspectacular. Likewise, its performance as demonstrated by PC Magazine Labs' *Windows* video performance tests in either 640-by-480 or 800-by-600 resolution at 16 colors is equally pedestrian. However, change the *Windows* driver to provide 256 colors at either of those resolutions and the card picks up speed. But even in 256-color modes, it still comes in behind the pack.

The Focus 2 the Max was also one of

seven boards we tested at 800-by-600 resolution with 32,768 colors—which is a result of its *Windows* driver for its Sierra RAMDAC. This time out, its large color palette did not seem to matter, and the Focus 2 the Max performed at slightly below-average levels.

Focus supplies a one-year warranty for its 2 the Max, and it guarantees a seven-day turnaround, with the board either repaired or replaced. The 72-Hz Super VGA ability alone is worth the price of admission for this card; you can consider anything else gravy.

Focus 2 the Max VGA 4000

Focus Information Systems Inc., 4046 Clipper Ct., Fremont, CA 94538; 415-657-2845. **List Price:** With 1MB DRAM and Sierra RAMDAC, \$220; without

Sierra RAMDAC, \$200. In Short: Although it did not hand in spectacular performance results, the 2 the Max VGA 4000's included Sierra HiColor RAMDAC, 72-Hz Super VGA compatibility, and low price make it worth a good look.

CIRCLE 626 ON READER SERVICE CARD

GENOA SYSTEMS CORP.
Genoa SuperVGA
6400VC

by Henry Fersko-Weiss

If you want spectacular color, then look no further than the Genoa SuperVGA 6400VC. It has an Edsun RAMDAC that gives you about 792,096 colors. Though it will only cost you \$229 list (or about \$150 on the street), you will pay a high price in speed: This board can be painfully slow.

Only one other reviewed board came with an Edsun RAMDAC, which offers Continuous Edge Graphics (CEG). In CEG mode you gain access to a color palette with 16.7 million colors and can display 792,096 at once. At the same time the separation between colors is smoothed so you get a fine gradation rather than an abrupt shift. The end result is images that look as rich and clear as a color photograph and lines or curves that are smooth and naturally rounded. If you're a *Windows* user and acquire the new BitStream fonts produced to take advantage of CEG, you'll get text on the screen that looks like it came from a laser printer.

But the color capability has to be balanced against the board's speed. On every one of the video performance tests we

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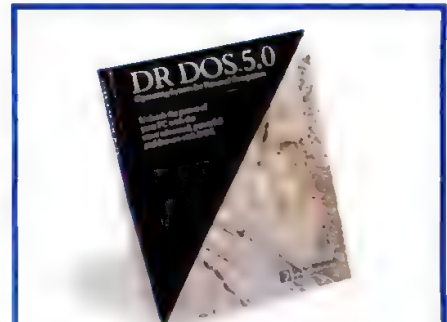
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	Okma ... NCP	
9696	Desktop Set 3.0 for Windows	85
	Passport Design ... NCP	
1329	Encore 2.0	379.
	PC Globe ... NCP	
5902	PC Globe 4.0	39.
5900	PC USA 2.0	39
	Personics ... NCP	
9288	Laptop Ultravision 2.1 (3 1/2" only)	49.
4384	Ultravision 2.0	79
7048	Monarch 1.0	319.

1-800/243-8088

MMG PC Connection 880M
6 Mill Street
Marlow, NH 03456
SALES 603/446-7721 FAX 603/446-7791



Microsoft ... NCP

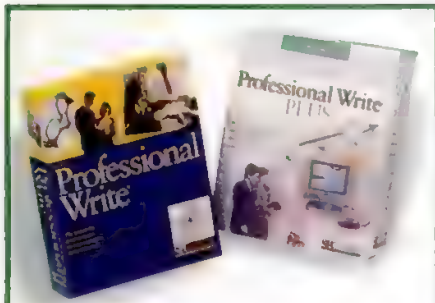
0137 **Office for Windows**—The best bundle of applications for Windows just got better. Now includes PC Mail (requires AppleTalk network running Microsoft Mail), Excel 3.0, PowerPoint, & Word for Windows at a new low price. \$499.

PowerUp ... NCP

7861	Address Book Plus 3.0	49.
7860	Calendar Creator Plus 4.0	52
7857	Labels Unlimited 3.0	59.
7858	Express Publisher 2.0	89.
	Precision Software ... NCP	
6600	Superbase 4 for Windows 1.3	429
	Qualitas ... NCP	
7539	386MAX 5.1	75.
7967	BlueMAX 5.1 for PS/2 (3 1/2" only)	85.
	Quarterdeck ... NCP	
6422	QRAM 1.0	54.
3221	Expanded Memory Mgr 386 5.1	65.
3220	DESQView 2.3	85.
4586	DESQView 386 2.3	145.
	QUE Software ... NCP	
4155	RightWriter 4.0	54.
1857	RightWriter 4.0 Network	169.
	Reality Technologies ... NCP	
7891	WealthStarter 1.0	39.
6572	WealthBuilder 1.1	99.
	Reference Software ... NCP	
4396	Grammatik IV 2.0	59.
7483	Grammatik for Windows 2.0	59.
	Revolution Software ... NCP	
4480	VGA Dimmer 3.0 (screen saver)	29.
	Roykore ... NCP	
8162	ABC Flowchart 1.1	189
	Sitka ... NCP	
6675	TOPS Network Bundle 3.0	159.
3720	Flashcard 2.1 (AppleTalk network card)	155.
7330	Flashcard MicroChannel	219.
	Softlogic Solutions ... NCP	
3542	Software Carousel 5.0	55.
	Software Publishing ... NCP	
3496	Professional Write 2.2	169.
9638	Professional Write Plus 1.0	169
9490	Harvard Graphics 1.0	269.
3482	Harvard Graphics 3.0 (limited time)	359.
	Software Toolworks ... NCP	
9859	Word for Word/Windows 4.2	47
9860	Word for Word/Professional 1.0	89.
	Solution Systems ... NCP	
7977	Brief 3.1 (Programmer's Editor)	189.
	Spinnaker ... NCP	
1415	PFS WindowWorks 1.0	129
7604	PLUS for Windows 2.0	289
	Stac Electronics ... NCP	
1409	Stacker 1.1	89.

PC CONNECTION®

1200 to 9600 bps.

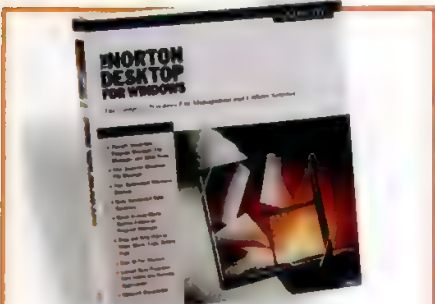


Software Publishing ... NCP

5033 Professional Write Plus 1.0 for Windows—Winner of PC Week's Document Processing Shootout... \$169.
3496 Professional Write 2.2 (for DOS)—The leading managerial word processor... 169.

Symantec ... NCP

6397	☐ The Norton Backup 1.2 (Windows/DOS)	105.
3146	☐ The Norton Utilities 6.0	119.
3425	☐ Q&A 4.0	269.
7999	☐ Norton Anti-Virus 1.0	89.
2359	☐ The Norton Desktop for Windows	105.
Systems Compatibility ... NCP		
9046	☐ Complete Writer's Toolkit 1.1	85.
8215	☐ Outside In 2.0	85.
6564	☐ Software Bridge 5.0	79.
Teleware ... NCP		
9847	☐ M.Y.O.B. for Windows	139.
TIMESLIPS ... NCP		
2987	☐ Timeslips III 4.0	195.
6994	☐ PercentEdge 1.0	69.
1270	☐ TimeSheet Pro 2.0	145.
Timeworks ... NCP		
6253	☐ Publish-It! 2.0	139.
T/Maker ... NCP		
1051	☐ Color Graphics Presentation 1.0	95.
	☐ ClickArt (EPS and Bitmap available)	call
Touchstone Software ... NCP		
7420	☐ Check It 3.0	89.
Traveling Software ... NCP		
5179	☐ LapLink III 3.0	95.
West Lake Data Corporation ... NCP		
7577	☐ PC-FullBak+ 2.0	52.
WordPerfect Corporation ... NCP		
7781	☐ LetterPerfect 1.0	129.
4214	☐ WordPerfect Office PC	89.



Symantec ... NCP

5035 Norton Desktop for Windows—Complete Windows file management and utilities solution. Includes an enhanced file manager, the fastest and most automated Windows backup, and data recovery tools... \$105.

3804	☐ WordPerfect 5.1	\$265.
6685	☐ DrawPerfect 1.1	279.
WordStar International ... NCP		
1482	☐ Correct Grammar 1.0 for Windows	65.
6791	☐ WordStar Professional 6.0	199.
XTREE ... NCP		
1202	☐ XTree Easy 1.0	45.
6161	☐ XTree Gold 2.0	95.
Z-Soft ... NCP		
1626	☐ Publisher's Paintbrush for Windows	299.

RECREATIONAL/EDUCATIONAL

Broderbund ... CP		
8068	☐ Where in the World is Carmen	
	San Diego Deluxe Edition	52.
1836	☐ Where in America's Past is	
	Carmen San Diego	39.
5851	☐ SimCity	33.
8886	☐ SimEarth	45.
Electronic Arts ... NCP		
4534	☐ Mavis Beacon Teaches Typing 1.0 (CP)	35.
1334	☐ Chuck Yeager Air Combat Trainer	42.
Harvard Associates ... NCP		
2324	☐ PC Logo 3.0	59.
HyperGlot Software ... NCP		
	(French, German, Italian, Spanish available.)	
	☐ Word Torture for Windows	ea. 34
	☐ Word Torture 3.0	ea. 29.



TIMESLIPS ... NCP

2987 ☐ Timeslips III 4.0—Know exactly who owes you what with this time and expense billing system. Perfect for service professionals (accountants, lawyers, etc.) who need to track and bill their time... \$195.

Microsoft ... NCP		
7881	☐ Entertainment Pack for Windows 1.0	29.
2858	☐ Flight Simulator 4.0	39.
8270	☐ Aircraft and Scenery Designer 1.0	29.
Microsoft Press (Books)		
8129	Running Windows (2nd Edition)	22.
8136	Running Microsoft Excel	22.
Penton Overseas ... NCP		
	☐ Vocabulary Levels I & II (French, Italian, German, Spanish, Russian, Hebrew and Japanese)	each 35.
Sierra ... CP		
9466	☐ Space Quest IV (VGA)	39.
7972	☐ King's Quest V (VGA)	45.
SirTech ... CP		
8235	☐ Bane of the Cosmic Forge	39.
Software Toolworks ... NCP		
4659	☐ Chessmaster 2100 (CP)	35.
7372	☐ World Atlas 2.0	42.
Stone & Associates ... NCP		
5231	☐ Phonics Plus 1.1	22.
3439	☐ 2nd Math 4.2	27.
Toyogo ... NCP		
7674	☐ Nemesis Go Master 4.7	41.
7676	☐ Nemesis Go Master Deluxe 4.7	88.
True BASIC, Inc. ... NCP		
	☐ Kemeny/Kurtz Math Series	each 45.



Central Point Software ... NCP

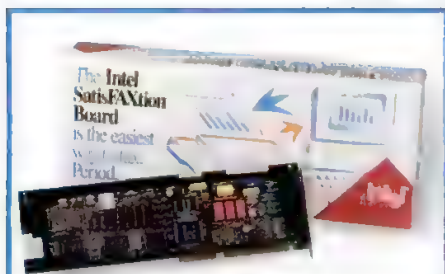
5039 ☐ PC Tools 7.2—A powerful group of integrated utilities, has more than a dozen major new functions as well as extensive Windows and Novell NetWare support... \$115.

HARDWARE

Warranties listed next to manufacturer.

Acme/SAFE Power Systems ... 2 years		
1948	Safe 300	199.
6747	Safe 400S	399.
American Power ... 2 years		
7108	Smart UPS 400	339.
7105	Smart UPS 600	469.
6811	Back-UPS 360	219.
7106	Back-UPS 520	329.
ATI Technologies ... 2 years		
9821	VGA Basic-16 (640 x 480, 16 colors)	85.
9985	VGA Integra (1024 x 768, 16 colors)	129.
9629	VGA Wonder XL (256K upgradable to 1MB)	199.
9619	Ultra/8514 Graphics Card (512K) (req. VGA)	419.
1838	Ultra/8514 & VGA (512K upgrade to 1 MB)	479.
1825	2400etc/i Modem (w/9600 SendFax)	139.
9620	9600etc/e Modem	379.
Boca Research ... 5 years		
7001	BOCARAM/AT PLUS (0k)	119.
7150	BOCARAM/AT PLUS (2 Meg)	219.
7139	(4 Meg)	329.
	7138 (8 Meg)	539.
6998	I/O Board for AT	59.
6999	I/O Board for Microchannel (S/S/P)	109.
8380	BasicVGA (256K, 640 x 480)	69.
8381	SuperVGA (1 Meg, 1024 x 768)	145.
Bravo Communications ... 2 years		
7400	2 Position Laser Compatible Switch Box	109.
Brown-Wagh ... 1 year		
8578	Creative Labs Sound Blaster	159.
Canon ... 1 year		
We are an authorized Canon Service Center.		
7894	BJ-10e Printer with free case (4.6 lb.)	329.
7897	BubbleJet Ink Cartridge (BJ-10e)	23.
7896	BJ-10e Sheet Feeder	75.
9828	BubbleJet Ink Cartridge (BJ-300 & BJ-330)	26.
CH Products ... 1 year		
7801	FlightStick w/Falcon	49.
7345	Rollermouse (Trackball) serial	85.
	bus	99.
CoStar ... lifetime		
6091	The Organizer (mobile storage cart)	199.
1418	AddressWriter Envelope Printer	469.
1812	LabelWriter II Printer	195.
Curtis ... lifetime		
9756	Keyboard Space Saver II KS-2	39.
1708	Ruby-Plus SPF-2+	65.
7358	Command Center SPF-4	89.
	Glass Filter Plus (specify size)	each 65.
Cyril Corporation ... 5 years		
MATH COPROCESSORS		
9875	FasMath 83D87-25	185.
9876	FasMath 83D87-33	195.
9877	FasMath 83S87-16 (SX compatible)	115.

360, 720, 1.44 MB.



Intel ... 5 years

7782 SatisFAXtion—Send & receive faxes with the 9600 bps fax or communicate with the 2400 bps MNP modem. Fax from within most any application by way of the print command. Supports background operation & installs easily... \$399.

Datadesk ... 3 years
6901 Switchboard... 159.
Epson ... 2 years
We are an authorized Epson Service Center. New 24 pin LQ printers offer scalable fonts and enhanced paper handling.

2358 LQ-570 (80 col., 252 cps)... 289.
2361 LQ-870 (80 col., 330 cps)... 489.
2357 LQ-1170 (136 col., 330 cps)... 669.
5184 LX-810 (80 col., 180 cps, 9 pin)... 185.

Everex ... 1 year
1683 Tempo LX Notebook (5 Meg, 60 Meg HD) 3499.
Hauptauge Computer ... 1 year
9031 20 MHz 386 Motherboard for PC... 995.
9032 20 MHz 386 Motherboard for XT... 995.
9870 25 MHz 386 Motherboard for AT... 1099.
9034 33 MHz 386 Motherboard for AT... 1339.

Hayes ... 2 years
2307 Smartmodem 2400... 349.
7391 Ultra 9600 Modem... 669.
9884 Pocket Edition 2400 Plus... 129.

Hewlett-Packard ... 1 year
9993 LaserJet IIIP (with toner)... 1149.
6754 LaserJet III (with toner)... 1679.

Hitachi ... 2 years
9492 CM1483M 14" SVGA Monitor (1024 x 768) 599.
Intel ... 5 years

6421 2400B MNP Internal Modem... 199.
5119 2400 Baud External Modem... 179.
6420 2400EX MNP Modem... 229.
7880 9600EX Modem... 529.
2346 Inboard 386/PC with 1 Meg... 495.
5336 Above Board Plus 8 2 Meg... 449.
5342 Above Board Plus 8 I/O 2 Meg... 479.
7782 SatisFAXtion (fax board)... 399.
8778 SatisFAXtion for Microchannel... 449.
8901 Matched Memory 2 Meg (PS/2)... 139.
8903 Matched Memory 4 Meg (PS/2)... 299.
Matched Memory (for LaserJet IIP, III, IIIP, IIID)
1810 1 Meg... 99. 1787 2 Meg... 299.
1637 Snap-In 386... 389.

MATH COPROCESSORS
7385 80287XL (16 MHz 80286 CPU's)... 89.
4750 80387SX (16 MHz 80386SX CPU's)... 129.
2372 80387-20 (20 MHz 80386 CPU's)... 219.
4121 80387-25 (25 MHz 80386 CPU's)... 219.

Kensington Microware ... 1 year
2582 Master Piece Plus... 99.
7899 Expert Mouse serial... 119. 7900 bus... 129.

Keytronic ... 3 years
4518 101 Plus Keyboard... \$99.
Kraft ... 5 years
5800 3 button Thunder Joystick... 29.
7862 TopTrak (Laptop Trackball)... 55.
Logitech ... limited lifetime
6029 Trackman serial... 85. 6028 bus... 89.
2343 Trackman Portable... 105.
1484 ScanMan 32... 169.
7975 ScanMan 256... 319.
8694 MouseMan (serial) 69. 9766 (cordless) 139.
Megahertz ... 5 years
1193 T324D 2400 Modem (for Toshiba Laptops) 129.
1196 T224 2400 Modem (for Toshiba Laptops) 129.
1187 T324FM 96/24 Fax Modem (Toshiba Laptops) 299.
1199 T52CC - 2 Meg Upgrade for Toshiba T1000 series or T2600SX... 299.
Micron Technology ... 2 years
7595 2 Meg Expansion for HP LaserJet IIP or III... 119.
7012 Memory Upgrade PS/2 70 - 2 Meg... 139.
Microsoft ... lifetime
7597 Microsoft Mouse (bus or serial)... 89.
2897 Mouse with Paintbrush (bus or serial) 105.
2898 Mouse with Windows 3.0 (bus or serial) 149.
1956 Mouse with Works (bus or serial)... 155.
1896 Ballpoint Mouse (serial only) 119.



Hayes ... 2 years

7391 Ultra 96 Modem—Get ultra high modem performance & error control without sacrificing compatibility. Supports CCITT V.32, V.42bis, Express 96, MNP Level 2-5, & standard 2400/1200/300 bps communications... \$669.

MicroSpeed ... 1 year
PC-TRAC Trackball
6007 serial... 75. 6008 bus... 89.
7271 Inport... 79. 6330 PS/2... 79.
Mouse Systems ... lifetime
5997 Trackball (1 yr. wrnty) serial... 65. bus... 69.
7878 PC Mouse III (serial) 89. (bus) 95.
NEC ... 2 years
9441 CDR36 Portable CD-ROM Drive... 399.
4799 Multisync 2A (VGA Monitor)... 499.
5085 Multisync 3Ds Monitor... 689.
Orchid Technologies ... 4 years
7863 ProDesigner VGA IIS (with 1 Meg)... 289.

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Micro Channel Technology

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Cyrix Corporation ... 5 years

FasMath Math Coprocessors—Outperform all others because they run Lotus 1-2-3, AutoCAD, Microsoft Windows family of products and other leading software faster by every available measure. New low prices see line listings.

PC Power & Cooling ... 1 year

REPLACEMENT POWER SUPPLIES

3203 Turbo Cool 200... 149.
7915 Turbo Cool 300... 165.
7053 InnerSource 2210 (power backup) 349.

Pacific Data Products ... lifetime

2255 Font Bank Cartridges (programmable, for LJ II, IIP, III, IIIP, si) 225.
6779 25 Cartridges in One! (for LJ II, IIP, III) 275.
8975 Complete Font Library (for LJ III) 275.
Memory upgrade for LaserJet IIP/III:
7055 2 Meg... 149. 7759 4 Meg... 259.
Memory upgrade for LaserJet II/IIID:
6838 2 Meg... 249. 6836 4 Meg... 379.
Pacific si Memory:
2252 1 Meg... 99. 2253 4 Meg... 319.
7158 Pacific Page PE 4.0 (for LJ IIP/III) 379.
6834 Pacific Page (for LJ II) w/2 Meg Mem. Brd. 379.
9833 Pacific Page XL (w/accelerator board) 799.

Panasonic ... 2 years

1410 KXP 1123 (240 cps, 80 col.) 249.
1419 KXP 1124i (240 cps, 80 col.) 319.
8144 KXP 1624 (192 cps, 132 col.) 399.



Canon ... 1 year

7894 BJ-12e BubbleJet Printer—Light weight, excellent print quality and a great price make this 4.6 lb. printer a winner. Choice of black or white. Includes free carrying case. Optional sheet feeder... \$329.

We have your number.

Practical Peripherals ... 5 years

3103	2400 Baud Internal Modem	\$129
3102	2400 Baud External Modem	179.
8993	2400 Baud Internal Modem (V.42 bis)	169
8994	2400 Baud External Modem (V.42 bis)	209
4542	2400 Baud Internal Modem for PS/2	229
8132	PM2400 Pocket Modem	109
7934	PM9600SA Modem	469.

Targus ... lifetime

1305	Universal Notebook (for ntbk. computers)	69.
6037	Premier Leather Carrying Case	179.

TheComplete PC ... 2 years

8082	TheComplete Half Page Scanner/400	289.
5828	TheComplete Communicator	449

Toshiba ... 1 year

9893	T2000SX Notebook (40 Meg)	2999.
9894	T1200XE Laptop (40 Meg)	2099
1773	T3200SX Laptop (120 Meg)	3499.

Tripp Lite ... 2 years

6199	Isobar 4-6 (4 outlets, 6 ft. cord)	49
6200	Isobar 6-6 (6 outlets, 6 ft. cord)	59.
6201	Isobar 8-12 (8 outlets, 12 ft. cord)	69
6018	LC1200 (1200W line conditioner)	159.
1528	PS6.0 (600VA on-line UPS)	559.

Video 7 ... 7 years

4931	VRAM II VGA 512k	259
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Zoom Telephonics ... 7 years

1307	2400 Baud w/9600 Baud Fax Modem	129.
1181	2400 Baud V.42bis Modem	159.



Logitech ... limited lifetime
2343 Trackman Portable—Designed to go anywhere, this portable trackball will attach easily to a laptop or notebook computer. Adjusts for either right or left hands. Includes soft carrying case ... \$105.

DRIVES

CD Technology ... 1 year

8057	Porta-Drive CD-ROM	649
8105	Installation Kit for Standard Bus	155.

Conner Peripherals ... 1 year

8875	CP3044 40 Meg IDE HD (25 ms)	299
2339	CP30104 120 Meg IDE HD (19 ms)	489
1337	CP3204 200 Meg IDE HD (16 ms)	899.

IOmega ... 1 year

We are an authorized Iomega Service Center.		
5116	Bernoulli II 44 Meg Internal	829
7551	Bernoulli II Transportable 44 Meg	call
2224	Bernoulli II Transportable 90 Meg	799
5113	44 Meg Cartridge Trnpak (5 1/4")	269
2500	PC2B Controller	209

Mountain Computer ... 2 years

2917	40-60 Meg Internal Tape Drive	259
5190	DC2000 Pre-formatted Cartridges	ea. 35.
6153	DC2180 Tape Cartridge (5 pack)	149.

Pacific Rim ... 1 year

1304	1.2 Meg External (for any parallel port)	265.
6602	1.44 Meg External (for PC/XT/AT)	239.

Plus Development ... 2 years

8304	Hardcard II XL 50 Meg (9 ms)	399
8287	Hardcard II XL 105 Meg (9 ms)	599

Seagate ... 1 year

4554	40 Meg Internal HD ST251-1 (28 ms)	\$249.
1321	ST157A 40 Mb IDE Hard Drive	229.
1320	ST1144A 130 Mb IDE Hard Drive	475.

TEAC ... 1 year

4670	1.44 Meg Drive for PC/XT (3 1/2")	69.
4326	1.44 Meg Drive for AT (3 1/2")	89
4951	720k Drive for PC/XT (3 1/2")	69.
6951	1.2 Meg Drive for AT (5 1/4")	75.

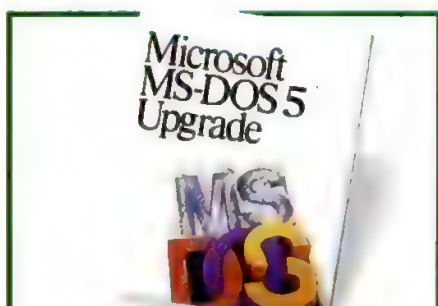
DISKS/MEDIA

Maxell ... lifetime

2789	5 1/4" MD2-D 360k Disks (Qty. 10)	10.
2790	5 1/4" MD2-D 1.2 Mb Diskettes (Qty. 10)	15.
2792	3 1/2" DS/DD 720k Diskettes (Qty. 10)	13.
2793	3 1/2" DS/HD 1.44Mb Diskettes (Qty. 10)	21.



Iomega ... 5 years
2224 Bernoulli II Transportable 90 Meg—Rugged and built to last, this drive will absorb 1000 g's of shock and provide 90 Meg of portable storage. Awards from Byte and InfoWorld. Requires adapter card ... \$799.



Microsoft ... NCP
1620 □ DOS 5.0 Upgrade—Improved graphical shell, on-line help, task swapping, full screen editor, and more are all awaiting you with DOS 5.0. Upgrade your current DOS with ease to DOS 5.0 for only ... \$65.

Sony ... lifetime

3291	5 1/4" DS/DD 360k Disks (Qty. 10)	8
3297	3 1/2" DS/DD 720k Diskettes (Qty. 10)	11.
3298	3 1/2" DS/HD 1.44Mb Diskettes (Qty. 10)	18
6148	3 1/2" DS/DD (3 Pack)	29.
6375	3 1/2" DS/HD (3 Pack)	49
8185	QD 2040 Tape Cartridge	19.
1895	QD 2120 Tape Cartridge	22
3M ... lifetime		
3943	DC 2000 Tape Cartridge	19
6065	DC 2080 Tape Cartridge	25
3944	DC 600 Tape Cartridge	29.
5679	DC 6150 Tape Cartridge	29.

MEMORY

6556	256k DRAM (100 ns, set of 9)	call
5510	1 Meg x 9 SIMMs (80 nanosecond)	call
5746	1 Meg Chips (80 ns, set of 9)	call
7813	256k x 4 Chips	call

OUR POLICY

- We accept VISA and MASTERCARD only.
- No surcharge added for credit card orders.
- Your card is not charged until we ship.
- If we must ship a partial order, we never charge freight on the shipment(s) that complete the order (in the U.S.).
- No sales tax, except Ohio residents (please add applicable tax).
- All U.S. shipments insured; no additional charge.
- APO/FPO orders shipped 1st Class Mail.
- International orders U.S. \$250 minimum. Manufacturer support and upgrade eligibility may be limited outside the U.S.A.
- Upon receipt and approval, personal and company checks clear the same day for immediate shipment of your order.
- COD max. \$1000. Cash, cashier's check, or money order.
- 120 day limited warranty on all products. Defective software replaced immediately. Defective hardware repaired or replaced at our discretion. All items subject to availability. Prices and promotions subject to change without notice.
- To order, call us Monday through Friday 8:00 a.m. to 1:00 a.m., or Saturday 9:00 a.m. to 5:30 p.m. Eastern Time. You can call our business offices at 603/446-3383 Monday through Friday 9:00 a.m. to 5:30 p.m.



Practical Peripherals ... 5 years
7934 PM9600SA Modem—Practical Peripherals does it again by making communications affordable with their newest modem featuring the data compression & error correction of 9600bps V.32 & V.42bis operation ... \$489.

SHIPPING

Note: Accounts on net terms pay actual shipping.

Continental US:

- For heavy hardware items such as printers, monitors, Bernoulli Boxes, etc. pay actual charges. Call for UPS 2nd-Day & Next-Day-Air.
- For all other items, add \$3 per order to cover UPS Shipping. For such items, we automatically use Airborne Express at no extra charge if you are more than 2 days from us by UPS ground.

Hawaii:

- For monitors, printers, Bernoulli Boxes, computers, hard drives, and power backups, actual UPS Blue charge will be added. For all other items, add \$3 per order.

Alaska and outside Continental US:

- Call 603/446-7721 for information.



PC Commitment.

Don't stand on ceremony.

(Or, why you should give us a ring.)

Here in the conjugal kingdom of Marlow, NH (pop. 566) we take our vows pretty seriously. In fact, this summer alone, a lucky 7 of our employees are getting hitched. Sure, we know some people think of country weddings as last-minute affairs that only take place thanks to the persuasive power of the proverbial shotgun. But actually, we believe in taking it slow and doing things right the first time. Whether it's baiting the hook or tying the knot.

And regardless of the local mating habits, rest assured that when you buy from us, we'll still love you tomorrow (by which time there's a

good chance your order will have arrived). Because when you're a PC Connection customer the honeymoon never ends, the bloom is never off the rose, and, most important of all, the tech support is always free. You'd be hard pressed to find a more perfect union.

Marriage is for the birds. (And bees.)

Know what happens to the rice that's thrown after a wedding? Little birdies often eat it and their tiny tummies start to ache. And that's no tweet. To remedy this fowl situation we're sending a wedding-season's supply of premium PC Connection birdseed (with a convenient reusable carrying pouch) to everyone who places an order of \$500 or more between now and September 30.



Don't get left at the altar without a supply of PC Connection birdseed. One per customer. Not available outside continental U.S.

PC CONNECTION

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HARDWARE

SVGA GRAPHICS ADAPTERS

ran on the 6400VC, it came in either last or very nearly last. Even compared with the average test scores, it had times that were up to 2.5 times as long. At its very best, it came in about average on a couple of tests. In CEG mode, however, the board surprisingly showed improvement.

There are two reasons for the poor performance results: a slow DAC and an old design. The Edsun DAC in the reviewed board ran at 50 MHz, whereas some other DACs, such as the Samsung, run at 80 MHz. Genoa will have an upgraded Edsun chip—running at 66 MHz—on the 6400VC by the end of July, claims a company spokesperson, adding that users of the present board will be able to upgrade for a nominal fee.

The second reason is the design of the



The 6400VC has
512K of DRAM, so
it can't go above
16 colors in high
resolution.

video processor chip—Genoa's own. The company spokesperson said the design is 18 months old, and "what was thought fast then is no longer fast." In the fall Genoa is due to produce a Super VGA

board with the Tseng ET4000 processor chip and the Edsun DAC, so it might pay to wait until then.

The 6400VC has only 512K of DRAM on it, so it cannot go above 16 colors at a resolution of 1,024 by 768. But it can handle 256 colors in 800-by-600 mode and a 72-Hz vertical refresh rate. The board proved to be fully VESA compliant and was easy to install. It comes with a good selection of drivers and adequate documentation.

If your work is particularly color sensitive, and speed does not matter to you, the Genoa SuperVGA 6400VC is an admirable board for the price. However, you should probably wait for the next series of products from Genoa to get a big improvement in speed at a price that will

STB'S FOUR-PORT SOLUTION

by Winn L. Rosch

Ordinary VGA boards strike out when you want to plug more than one monitor into your PC—unless you'll settle for the minor-league solution of adding a monochrome-only display that follows the MDA standard. Put MVP by STB on your team, however, and your PC will be able to handle four Super VGA displays. You can even add up to four MVPs to one PC for a total of 16 monitors.

The company explains that MVP stands for Multiple VGA Port Adapter. And the board follows this description exactly: It adds multiple independent Super VGA output ports to your PC. Each port is connected to the equivalent of a complete Super VGA adapter; each one has its own Tseng Laboratories ET4000AX VGA chip, 512K or 1MB of 100-nanosecond memory, and a Samsung RAMDAC. A single BIOS serves all four ports.

Because four 15-pin high-density D-shell VGA connectors won't fit on a single card retaining bracket, the MVP offers mini-DIN plugs and five-inch adapters to standard VGA cables. The system side of the interface is a 16-bit ISA edge connector, although on-board jumpers allow you to select 8-bit operation. The board fits in any full-length, XT-height expansion slot.

STB offers four models of MVP to suit different applications. Two-port

boards with 512K or 1MB of RAM per port retail for \$999 and \$1,099 respectively; four-port boards with 512K or 1MB per port list at \$1,799 and \$1,999.

Each of the two or four on-board ports is completely VGA and VESA compatible with the ability to display up to 256 simultaneous on-screen colors from a palette of 262,144 at resolutions up to 1,024 by 768 pixels. (With 512K of RAM, only 16 colors are available at highest resolution.) Drivers are included for *Windows* 3.0 and Presentation Manager for operation with two to four displays at VGA and 800- by 600-pixel resolutions.

Either of the driver sets allows you to spread a virtual desktop across up to four screens arranged vertically, horizontally, or in a two-by-two square, selectable when you install the driver. Move your mouse beyond the edge of one screen and it appears at the edge of the adjacent display. With ordinary *Windows* commands, you can move a separate application to each screen or unfurl a really wide spreadsheet.

Applications outside the purview of the included drivers will require custom programming. All four ports on a board use the standard VGA address range. Each is switched individually on and off using a single on-board register. Switch all four ports on at once and all four monitors connected to the MVP will display the same image.

Independently enable and disable each port and you can put separate images on each screen. Use time slicing to simulate simultaneous repainting on the four independent screens.

While 4 or 16 screens might seem superfluous since most people have only two eyes and one train of thought, they can be invaluable for debugging (keep the application under development on one screen and the code on the other), designing (with the image on one screen and the control menu on the other), business (big spreadsheets can stretch across multiple screens), or information displays (by displaying airline flight information on screens in different locations). While the MVP is definitely a specialized player with a limited market, it can be the ideal solution when a single screen just isn't enough. ■

MVP by STB

STB Systems Inc., 1651 N. Glenville, #210, Richardson, TX 75081; 214-234-8750. **List Price:** With two ports of 512K RAM each, \$999; with two ports of 1MB RAM each, \$1,099; with four ports of 512K RAM each, \$1,799; with four ports of 1MB RAM each, \$1,999. **Requires:** One VGA- or-better monitor per port for standard video modes, or one high-resolution monitor per port for Super VGA modes.

CIRCLE 617 ON READER SERVICE CARD

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"Pizazz Plus: Finally—An easy way to capture and print screen images" **PC World**³

"Pizazz Plus is an excellent screen capture program, producing high-quality output, saving files in several formats and providing the best color adjustment features of any reviewed products." **PC Week**⁴

"Pizazz...was a phenomenal product and Pizazz Plus is a lot better yet." **Computing Now**⁵

"For such a complex program, ease of use is one of Pizazz Plus' main features." **Ventura Professional**⁶

"Pizazz Plus is a reasonably priced, useful utility for a variety of applications" **Info World**⁷

"Pizazz Plus provides the most sophisticated mapping of screen colors to black-and-white printer output." **PC Magazine**⁸

"It's well worth the price" **Home Office Computing**⁹

"Pizazz Plus offers an extraordinary package for color oriented publications work." **Ventura Professional**¹⁰

"Pizazz Plus—The Ultimate Screen Dump Utility. There's no question that Pizazz Plus is another one of those products that few of us can get along without. It should be included when you buy DOS." **Computing Now**¹¹

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HARDWARE

SVGA GRAPHICS ADAPTERS

be only slightly higher.

Genoa SuperVGA 6400VC

Genoa Systems Corp., 75 E. Trimble Rd., San Jose, CA 95131; 408-432-9090. **List Price:** With 512K DRAM and Edsun RAMDAC, \$229. **In Short:** The SuperVGA 6400VC features an Edsun RAMDAC, which offers Continuous Edge Graphics and nearly 792,096 simultaneous colors, but it does so at a severe performance cost.

CIRCLE 627 ON READER SERVICE CARD

MICRO EXPRESS

Micro Express VGA/72 Hz

by Kellyn Betts

The \$225 Micro Express VGA/72 Hz offers a competitive price, while its Tseng Laboratories chip set put out slightly above-average performance but arrived in a package that lacked even some of the rudimentary basics.

Lots of serious techies eschew manuals. But some of our other readers may not be able to figure out that the card is capable of generating a 1,600-by-1,024 resolution (which admittedly has a rather odd aspect ratio and comes with only two colors). And setting up the card to run is tricky, too. Also, the manufacturer's directions for preparing *Microsoft Windows* to display either of the 256-color drivers are not particularly helpful.

We were also disconcerted because the first card we received failed to generate the 72-Hz vertical refresh rate its name pledged, although the second card lived up to its label.

But aside from the package's shortcomings, the board did respectably on PC Magazine Labs' performance tests. Its overall 16-color times for both VGA and Super VGA modes were in the top half of the roundup. And its 256-color results were both only average.

The 72-Hz card we reviewed is at the high end of Micro Express's line. All are built around the Micro Express Extended VGA card, which comes in 256K (\$150), 512K (\$175), and 1MB (\$225) versions. The 72-Hz model we reviewed has a faster oscillator on it, while a Sierra HiColor card includes a Sierra RAMDAC. All come with a one-year warranty.

From a price and performance perspective, *PC Magazine* cannot fail to recommend the fast, inexpensive, high-

resolution Micro Express VGA/72 Hz. We also recommend you call the company and ask about the promised packaging improvements before buying it, however.

Micro Express VGA/72 Hz

Micro Express, 1801 Carnegie Ave., Santa Ana, CA 92705; 714-852-1400.

List Price: With 1MB DRAM, \$225. **In Short:** The VGA/72 Hz offers very good performance with a highly competitive price. It is worth checking out, but remember to ask for some promised improvements to the packaging before buying.

CIRCLE 628 ON READER SERVICE CARD

MICRO-LABS INC.

Micro-Labs Ultimate VGA/HiColor

by Oliver Rist

Micro-Labs is based in Dallas, Texas, and has been in the microcomputer graphics market since 1978. Its \$299 Ultimate VGA/HiColor graphics adapter proved one of the better buys of this roundup.

The Ultimate VGA/HiColor's package arrives bulging with bundled features. All the basics are diligently attended to: The user manual covers not only installation but also includes a fine troubleshooting section as well as warranty, software driver, and some programming information. The package has a powerful utility disk that handles installation and also contains diagnostic, fast BIOS, display-



Micro-Labs attended
to all the basics
with the Ultimate
VGA/HiColor.

mode selector, and screen-blanking programs. There is a custom-font loader and font editor, too.

The 16-bit Ultimate VGA/HiColor measures four inches high by almost eight inches long and comes equipped with 256K, 512K, or 1MB (our tested configuration) of DRAM memory, as well as a 32,768-color Sierra RAMDAC. The board is VESA compliant via a 3K TSR.

In terms of resolution, this adapter (which has an FCC class A rating) supports a 1,024-by-768 resolution in 16 colors at almost a 70-Hz vertical refresh rate. It also handles VGA and Super VGA modes at the VESA-sanctioned 72-Hz refresh. Micro-Labs claimed it recently completed a 16-color 1,280-by-1,024-mode driver shortly before this article was printed, but there was no time for us to test the new driver.

On performance, the Ultimate VGA/HiColor's Tseng Laboratories chip set turned in average to above-average results on all PC Magazine Labs tests. It did better on some of the 256-color tests, both in VGA and Super VGA modes—because of a well-optimized driver for *Windows*.



MORE MEMORY. MORE MODES

To get higher resolutions and more colors, you will have to buy more memory. Super VGA boards need 1MB of video memory to display 1,024 by 768 pixels in 256-color mode.

256K	512K	1MB
640 by 480, 16 colors	640 by 480, 16 colors	640 by 480, 16 colors
640 by 480, 256 colors	640 by 480, 256 colors	640 by 480, 256 colors
800 by 600, 16 colors	800 by 600, 16 colors	800 by 600, 16 colors
	800 by 600, 256 colors	800 by 600, 256 colors
	1,024 by 768, 16 colors	1,024 by 768, 16 colors
		1,024 by 768, 256 colors

**"We make Windows™ scream
— so you don't have to"**

... Ho



Although not the fastest board of the group, the Micro-Labs Ultimate VGA/HiColor's competitive combination of price, 256-color performance, and features still make it a solid buying choice. You can buy the board directly from Micro-Labs, or you can also find it OEMed in systems by Creative Computer Prod-

ucts (Florida) and Cheetah Computer (Minnesota).

Micro-Labs Ultimate VGA/HiColor
Micro-Labs Inc., 7309 Campbell Rd.,
Dallas, TX 75248; 214-702-8654. **List Price:** With 1MB DRAM and Sierra

RAMDAC, \$299; with Edsun RAMDAC, \$299. **In Short:** The Ultimate VGA/HiColor is one of the better values of this roundup. Lots of features, good performance, high-color capability, and a low price make this board worth a very close look.

CIRCLE 629 ON READER SERVICE CARD

FROM THE OEM FRONT: Western Digital's 1024 CX and 1024 DX

As Western Digital moves away from end-user distribution, its 1024 DX dives into the OEM channel, causing quite a splash on our tests.

by John R. Quain

Until 1986, 20-year-old Western Digital Corp. was known primarily as a manufacturer of PC disk storage controllers. But that year the company moved into the more colorful business of video adapter cards by purchasing Paradise Systems. Two years later, encouraged by the success of the Paradise subsidiary—which shipped its one millionth VGA card in 1988—Western Digital sought to expand its video offerings into the CAD market and acquired Verticom, a high-end imaging hardware company.

Since the end of the acquisitive 1980s and the start of the austere 1990s, the Verticom name has disappeared, and the parent company's Western Digital Imaging division has taken up the pursuit of high-end customers with such products as the enhanced 8514/A-compatible WD9510AT. Meanwhile, in the mainstream market, Paradise has not introduced a new product since the VGA 1024 Card back in March 1990, and newer designs have caught up with its boards' performance.

Furthermore, a southern California company, Ingram Micro, has become the sole distributor of Paradise adapters while Western Digital "refocuses on the OEM channel," according to a company spokesperson. (Western Digital emphasizes that it will continue to support and service its Paradise products.)

PC buyers are not likely to see any

new Paradise retail offerings, but if Western Digital has its way, shoppers will be seeing plenty of Western Digital VGA adapter designs with labels such as CT Continental (408-727-8038), Fountain Technologies (908-563-4800), and Sun Moon Star Group (408-452-7811). Now Western Digital is making an end run at the mainstream Super VGA market with two designs that the company is licensing out to other vendors: the \$299 Western Digital 1024 CX and the new \$499 Western Digital 1024 DX.

The 1024 CX is basically the same model as the Paradise VGA 1024 Card. It is a 16-bit ISA card employing the WDC90C11 video controller, 512K of DRAM, and a Brooktree RAMDAC. It is capable of simultaneously displaying 16 colors in Super VGA mode at a 72-Hz vertical refresh rate.

On PC Magazine Labs' VGA tests, the 1024 CX's performance was average to below average when compared with others in this roundup. It elicited good to fair results on our *Windows* performance tests in 16-color modes under VGA and Super VGA, but when we increased the number of colors to 256, it fell behind the rest of the pack.

The 1024 DX really shone. Designed as a lower-cost, screen-to-screen competitor to the Tseng Laboratories ET4000 VGA controller, the Western Digital 1024 DX exceeded the performance of the older 1024 CX and demonstrated some impressive performance against Tseng-based boards

in PC Labs' tests. The 1024 DX model PC Labs tested included preliminary drivers, and Western Digital had not yet signed licensing deals on the design at press time, so we could not qualify the 1024 DX for inclusion in this issue's regular roundup. We did put it through PC Labs' performance tests to determine how promising its future looks.

As tested, the 1024 DX included all the features of the 1024 CX as well as a number of significant improvements owing to a new Western Digital controller, the WD90C30. Filled with 1MB of single-ported DRAM, the 1024 DX surpasses the 1024 CX, delivering 256 simultaneous colors in Super VGA mode at a 72-Hz vertical refresh rate or a noninterlaced 1,024- by 768-pixel resolution with 256 simultaneous colors and a vertical refresh rate of 70 Hz. The 1024 DX put in a very strong showing against comparable boards, leading in one-third of the VGA tests and demonstrating that it can compete BitBlt for BitBlt.

Superior software integration also enabled the 1024 DX's *Windows* drivers to run with the leaders. It led the pixel race in 16-color performance under *Windows* in VGA and Super VGA, and when pushed to 256 simultaneous colors, it managed to stay with the top three sprinters.

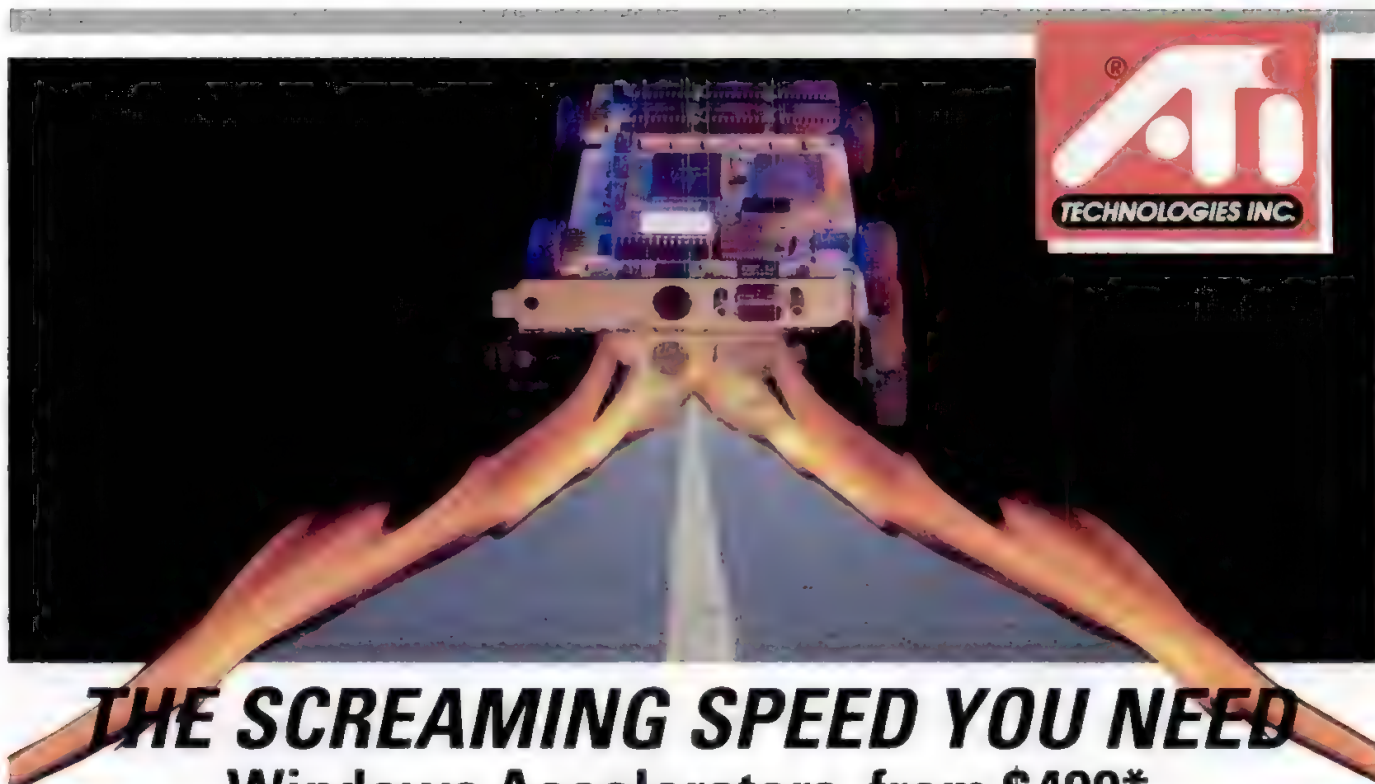
These are promising results for an as yet unfinished product. We look forward to end-user products based on the 1024 DX. ■

Western Digital 1024 CX

Western Digital 1024 DX

Western Digital Corp., 800 E. Middlefield Rd., Mountain View, CA 94043; 415-960-3353. **List Price:** 1024 CX, \$299; 1024 DX, \$499.

CIRCLE 542 ON READER SERVICE CARD



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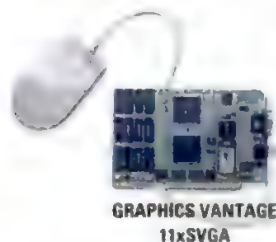
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HARDWARE

SVGA GRAPHICS ADAPTERS



PERFORMANCE TESTS: SUPER VGA ADAPTERS

In terms of raw throughput, the clear-cut winner on our VGA performance tests was the Tseng ET4000 chip set. Boards that used it beat their competitors by a wide margin.

HOW WE TESTED

We tested each board in a Compaq Deskpro 386/25e equipped with 4MB of RAM and a 310MB hard disk, with the Compaq's built-in VGA disabled. All systems were equipped with Compaq DOS, Version 4.01.

To test the capabilities of the reviewed boards, PC Magazine Labs tested them in a variety of different environments. To examine VGA performance, we used PC Labs' VGA tests, developed in conjunction with Spirit of Performance. Because these tests do not use drivers or other software overhead to exercise the VGA circuitry, they accurately represent the VGA circuitry's performance.

WHAT THE NUMBERS MEAN

The 21 Super VGA boards we tested were based on chip sets from seven manufacturers: Ahead Systems, ATI Technologies, Chips and Technologies, Genoa Systems Corp., Trident Microsystems, Tseng Laboratories, and Video Seven/Headland Technology. For comparison, we are also reporting results for the VGA built into the Compaq Deskpro 386/25e (which runs at 640-by-480 resolution).

On PC Magazine Labs' VGA Performance Tests (which measure raw throughput), Tseng's ET4000 surpassed the competition by quite a wide margin. The boards based on Tseng chips yielded results that were clearly superior on our Move Full-Screen Text, 640-by-480 Fill, and 320-by-200 tests. (In fact, the Tseng-

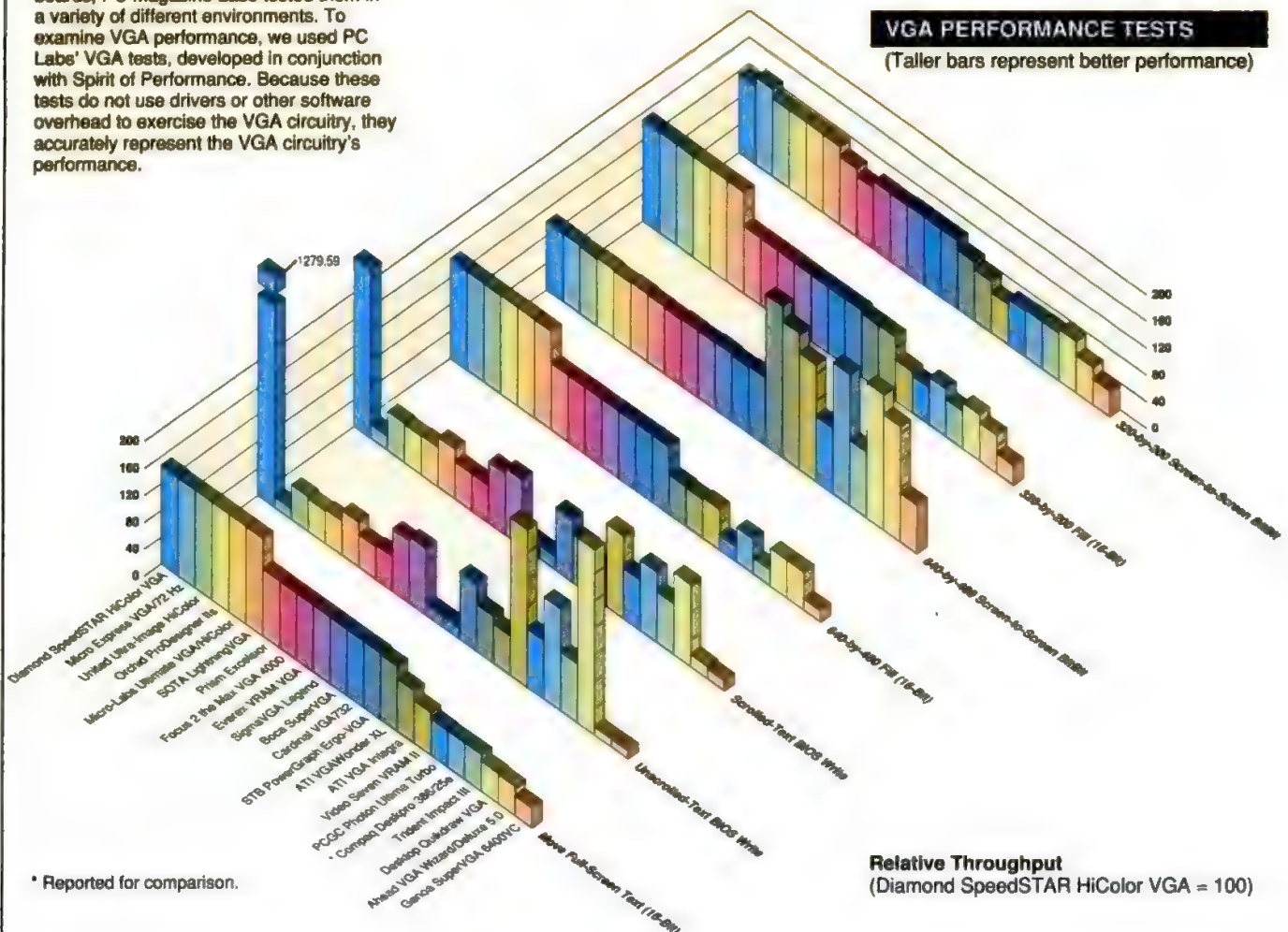
based units are the first 13 boards listed in our chart of results for these tests.)

Half of the Tseng-based boards were clearly superior to the other half on most tests. Using Tseng's turbo mode for zero wait states, these six boards (the Diamond SpeedSTAR HiColor VGA, Micro Express VGA/72 Hz, Micro-Labs Ultimate VGA/HiColor, Orchid ProDesigner IIs, SOTA LightningVGA, and United Ultra-Image HiColor) achieved results that were 14 to 50 percent higher than their siblings. The one-wait-state Tseng-based boards still beat the non-Tseng boards.

The leading non-Tseng boards on our video tests were ATI's VGA Integra and VGAWonder XL, both of which use ATI's own video controller. Both of these cards

VGA PERFORMANCE TESTS

(Taller bars represent better performance)



* Reported for comparison.

Relative Throughput
(Diamond SpeedSTAR HiColor VGA = 100)

HARDWARE

SVGA GRAPHICS ADAPTERS

closely followed the Tseng pack.

The Cardinal VGA732 is a zero-wait-state board, but its performance was no faster than that of the BOCA SuperVGA board, using one wait state. Cardinal declined to explain this discrepancy; the company reported that it has fixed the problem, but was unable to provide us with a new board.

The Genoa SuperVGA 6400VC was a consistently slow performer. It came in last in every category except the Unscrolled-Text BIOS Write test, where it was second-slowest. Using 512K RAM, the Genoa uses one of the oldest designs in this roundup, and the scores show its relative age.

Both the Unscrolled- and Scrolled-Text BIOS Write test results are a measure of

BIOS efficiency and the board's ability to process DOS video commands. Text applications such as word processors and editor/compiler can sometimes take advantage of a speedy BIOS. Some manufacturers stress this feature and optimize their BIOS to produce high throughput numbers; this was the case with the Diamond board and to a smaller extent the Desktop and Video Seven units. Though we perform all of our tests without the aid of any software drivers, use of a video RAM-shadowing driver would yield improvements in the BIOS scores.

Five boards excelled on the 640-by-480 Screen-to-Screen BitBlt test, indicating strong graphics-handling capabilities. These boards (the Ahead, the ATI VGA

Integra and VGAWonder XL, the Desktop, and the Video Seven) ran up to twice as fast as other boards.

Both Desktop and Video Seven employ VRAM, which makes simple work of the memory-intensive BitBlt operation. Interestingly, the Everex board we tested did not use VRAM, but it does have the capability; if Everex had sent us a unit with VRAM installed, we would have expected more striking results on the 640-by-480 BitBlt test. This is the one test where the Tseng-based boards did not excel.

Because all 21 boards used a true 16-bit interface, we have not reported their scores on the 8-bit Move Full-Screen Text test. The 8-bit results indicated roughly half the throughput of the 16-bit results.

■ **The Move Full-Screen Text (16-Bit)** test writes text to the graphics adapter's screen memory via 16-bit moves. A full-screen move best represents adapter throughput because there is almost no software overhead involved. We run the test for 10 seconds and report the results in kilocharacters per second (1 kilocharacter = 1,000 characters).

■ **The Unscrolled-Text BIOS Write** test writes text to the screen via interrupt 10h BIOS calls. After the program fills the screen with text, the cursor moves back to the top of the screen and repeats the procedure. This test measures the video BIOS's efficiency. We run the test for 10 seconds and report the results in kilocharacters per second.

■ **The Scrolled-Text BIOS Write** test writes text to the screen via interrupt 10h BIOS calls. After the program fills the screen with text, each successive text line is teletyped to the bottom of the screen, and a line

of text at the top is erased. This test measures forced-scrolling text performance loss and examines the efficiency of the board's video BIOS. We run the test for 10 seconds and report the results in kilocharacters per second.

■ **The 640-by-480 Fill (16-Bit)** test fills the video memory with color information via VGA write mode 0 (a common write mode used by many software programs). This test measures the graphics adapter's throughput in graphics mode. We run the test for 10 seconds and report the results in megapixels per second (1 megapixel = 1,000,000 pixels).

■ **The 640-by-480 Screen-to-Screen BitBlt** test divides video display memory into four sections. The first three sections contain different-colored fill patterns. This test measures the graphics adapter's performance when it moves pixels from these three sections to the fourth; it minimizes the effects of the system

bus. We run the test for 10 seconds and report the results in megapixels per second.

■ **The 320-by-200 Fill (16-bit)** test fills the video memory with color information utilizing the 256-color VGA mode at 320-by-200 resolution. This test predicts 256-color Super VGA performance. We run the test for 10 seconds and report the results in megapixels per second.

■ **The 320-by-200 Screen-to-Screen BitBlt** test divides video display memory into four sections. The first three sections contain different-colored fill patterns. This test measures the graphics adapter's performance when moving pixels from these three sections to the fourth; it also predicts the graphics adapter's performance in 256-color Super VGA mode while minimizing the effects of the system bus. We run the test for 10 seconds and report the results in megapixels per second.

VGA PERFORMANCE TESTS

(Higher scores represent better performance)

	Move Full-Screen Text (16-Bit) (kilocharacters per second)	Unscrolled-Text BIOS Write (kilocharacters per second)	Scrolled-Text BIOS Write (kilocharacters per second)	640-by-480 Fill (16-Bit) (megapixels per second)	640-by-480 Screen-to-Screen BitBlt (megapixels per second)	320-by-200 Fill (16-Bit) (megapixels per second)	320-by-200 Screen-to-Screen BitBlt (megapixels per second)
Diamond SpeedSTAR HiColor VGA	3,597.44	240.85	33.03	62,998.43	5,116.70	7,970.84	2,227.99
Micro Express VGA/72 Hz	3,575.35	3.23	2.83	62,783.31	5,093.65	7,970.84	2,498.49
United Ultra-Image HiColor	3,573.05	9.80	7.64	62,537.46	5,024.51	7,970.84	2,226.39
Orchid ProDesigner IIs	3,568.63	9.17	7.36	62,414.54	5,116.70	7,970.84	2,224.79
Micro-Labs Ultimate VGA/HiColor	3,566.71	9.69	7.60	62,537.46	5,024.51	7,970.84	2,226.39
SOTA LightningVGA	3,559.99	12.73	9.60	62,537.46	5,124.38	7,970.84	2,226.39
Prism Excelsior	2,449.64	9.26	7.24	42,500.89	5,032.19	5,320.29	1,957.50
Focus 2 the Max VGA 4000	2,448.49	9.74	7.28	42,500.89	4,955.36	5,320.29	1,744.62
Everex VRAM VGA	2,444.26	17.67	11.94	42,500.89	5,062.92	5,320.29	1,944.69
SigmaVGA Legend	2,444.07	18.82	13.06	42,439.43	5,032.19	5,320.29	1,927.09
Boca SuperVGA	2,443.88	3.18	2.82	42,500.89	5,124.38	5,320.29	1,957.50
Cardinal VGA732	2,443.88	3.21	2.77	42,500.89	5,009.14	5,320.29	1,957.50
STB PowerGraph Ergo-VGA	2,443.88	18.91	12.34	42,500.89	5,116.70	5,320.29	1,959.10
ATI VGAWonder XL	2,389.52	13.25	9.60	25,260.83	11,355.08	5,083.41	1,681.80
ATI VGA Integra	1,946.04	11.08	7.52	24,584.75	10,225.72	5,086.21	1,485.33
Video Seven VRAM II	1,567.47	44.18	16.21	25,752.53	8,742.95	3,316.38	1,163.61
PCGC Photon Ultima Turbo	1,375.02	16.62	9.89	9,987.56	4,916.95	3,028.28	1,346.08
* Compaq Deskpro 386/25e	1,346.17	28.70	13.72	22,280.00	9,840.00	3,830.00	1,360.00
Trident Impact III	1,345.25	16.62	9.89	10,294.87	4,901.59	3,009.07	1,370.09
Desktop Quikdraw VGA	1,097.10	51.86	15.92	23,908.67	10,087.43	3,681.31	1,477.33
Ahead VGA Wizard/Deluxe 5.0	1,060.80	2.40	2.42	23,908.67	8,596.98	2,996.27	1,077.18
Genoa SuperVGA 6400VC	720.45	2.42	2.01	7,344.69	3,664.67	1,568.56	737.86

* Reported for comparison.

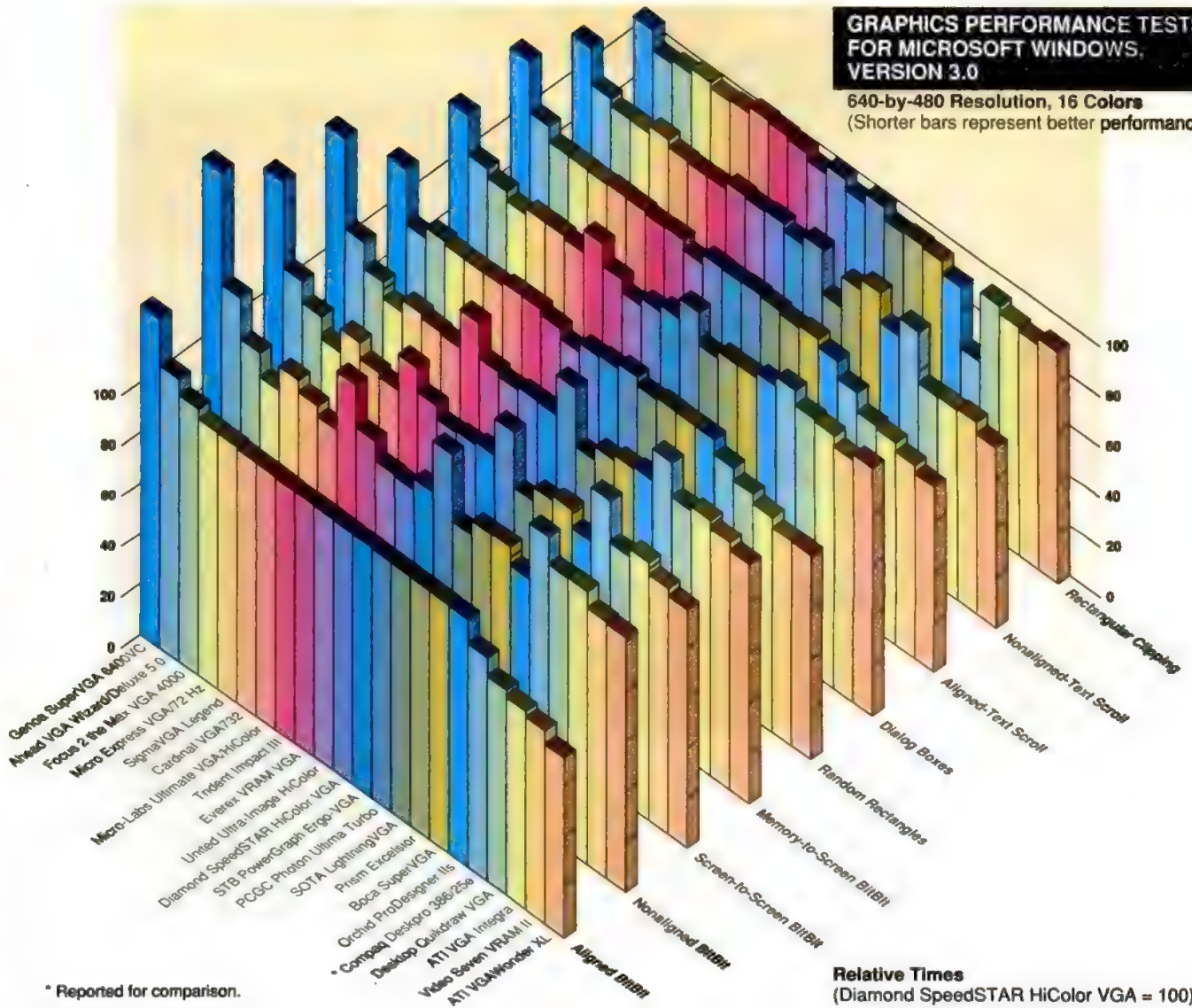


PERFORMANCE TESTS: SUPER VGA GRAPHICS ADAPTERS

On PC Labs' *Windows* tests, Super VGA boards with proprietary drivers performed far better than those that relied on the generic *Microsoft Windows* driver. Two VRAM-based boards, the Video Seven VRAM II and the Desktop Quikdraw VGA, were the top two performers overall. ATI's VGA Integra and VGAWonder XL cards excelled in standard 16-color VGA and Super VGA modes. The two 512K boards—the ATI VGA Integra and the Genoa SuperVGA 6400VC—suffered in 256-color modes.

GRAPHICS PERFORMANCE TESTS
FOR MICROSOFT WINDOWS,
VERSION 3.0

640-by-480 Resolution, 16 Colors
(Shorter bars represent better performance)



* Reported for comparison.

Relative Times
(Diamond SpeedSTAR HiColor VGA = 100)

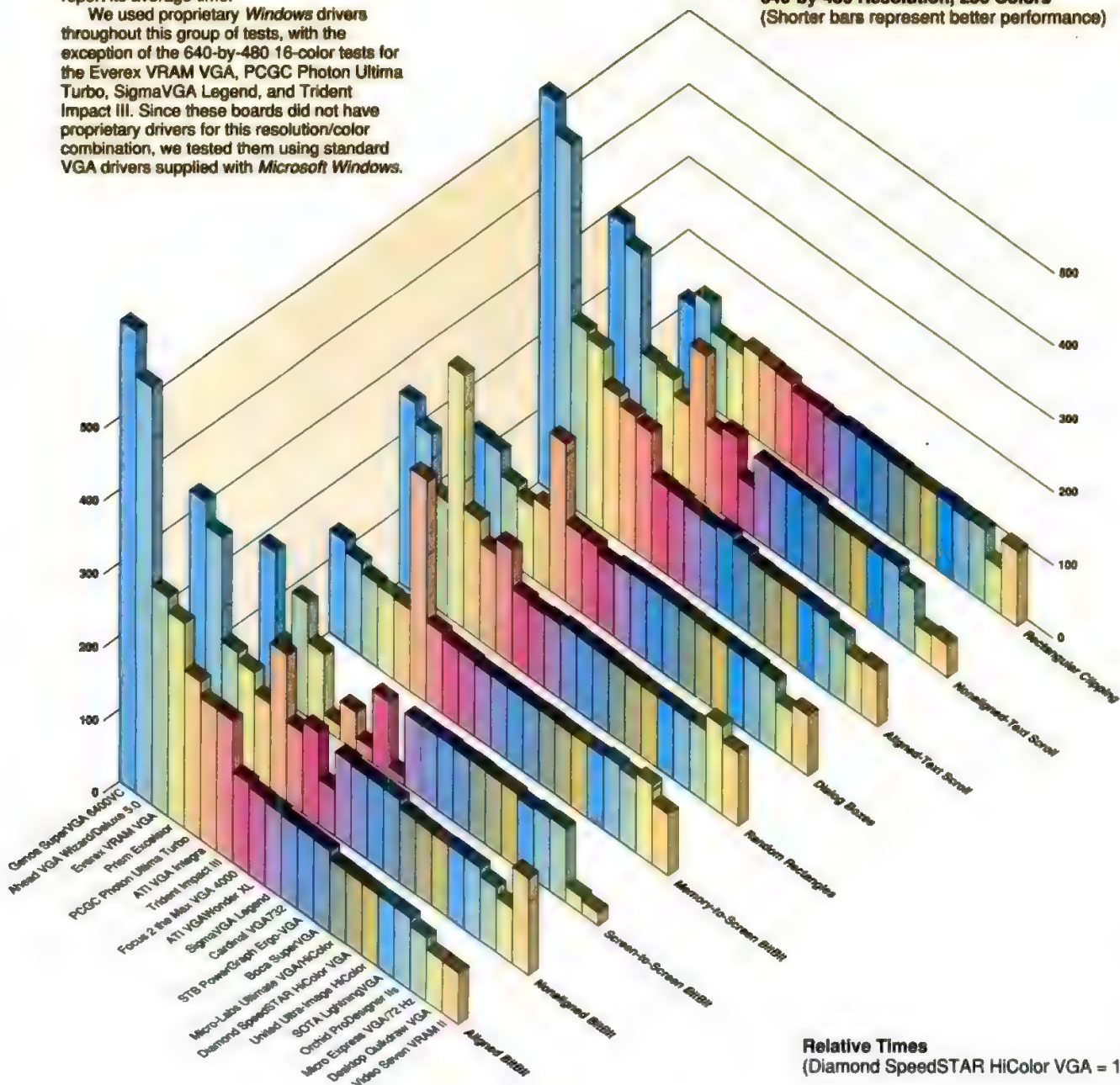
HOW WE TESTED

To reveal the performance differences of the boards when running *Microsoft Windows 3.0*, we used Release 1.1 of PC Magazine Labs' Graphics Performance Tests for *Microsoft Windows* on the same test-bed we use for the VGA performance tests. Each product performed ten iterations of each test, and we report its average time.

We used proprietary *Windows* drivers throughout this group of tests, with the exception of the 640-by-480 16-color tests for the Everex VRAM VGA, PCGC Photon Ultima Turbo, SigmaVGA Legend, and Trident Impact III. Since these boards did not have proprietary drivers for this resolution/color combination, we tested them using standard VGA drivers supplied with *Microsoft Windows*.

GRAPHICS PERFORMANCE TESTS FOR MICROSOFT WINDOWS, VERSION 3.0

640-by-480 Resolution, 256 Colors
(Shorter bars represent better performance)



CONTINUES

PERFORMANCE TESTS: SUPER VGA GRAPHICS ADAPTERS

WHAT THE NUMBERS MEAN

On the 640-by-480 16-color tests, we noted that the boards based on Tseng Laboratories chips yielded similar timings, closely matching or bettering the internal VGA of the Compaq Deskpro 386/25e (which we were able to use as a reference only for this resolution/color combination). Yet the ATI VGAWonder XL, Video Seven VRAM II, ATI VGA Integra, and Desktop Quikdraw VGA—which are not Tseng-based—were the fastest of all; they excelled on our Aligned BitBlt

and scrolling tests. The Genoa SuperVGA 6400VC, utilizing a video chip of Genoa's own design, produced the worst scores in the group.

The 640-by-480 256-color tests again have the Tseng-based boards grouped together, with similar results on all tests. The Everex VRAM VGA and the Prism Excelsior fared poorly at this resolution/color combination, yielding the slowest scores among the Tseng boards. Both boards produced much better results on the 16-color

tests at this resolution, indicating a weakness in their 640-by-480 256-color drivers.

The Desktop Quikdraw VGA and the Video Seven VRAM II, while not clear winners, were the best overall. Both boards employ VRAM and optimized drivers to produce faster throughput numbers. The Genoa SuperVGA 6400VC and Ahead VGA Wizard/Deluxe 5.0 were the hands-down losers at this resolution/color combination, followed by the ATI VGA

GRAPHICS PERFORMANCE TESTS FOR MICROSOFT WINDOWS, VERSION 3.0

■ **The Aligned BitBlt test** draws a 256-by-256-pixel square and uses the *Microsoft Windows 3.0* function BitBlt (bit-block transfer) to move it from one on-screen location to another—which is similar to moving a cursor, icon, or window across the screen. Using aligned BitBlts requires little CPU overhead because it is not necessary to compute the screen-memory offset position. We run the test ten times and report the average timing.

■ **The Nonaligned BitBlt test** draws a 256-by-256-pixel square and uses the *Windows* BitBlt function to move it from one on-screen location to another. Using non-aligned BitBlts requires a tremendous amount of CPU overhead because it is necessary to compute the screen-memory offset position. We run the test ten times and report the average timing.

■ **The Screen-to-Screen BitBlt test** uses the *Windows* BitBlt function to move data from one area of screen memory to another. It performs a number of *Windows* raster operation functions to manipulate bitmaps while performing BitBlt operations. This test measures the efficiency of the *Windows* driver as it minimizes the effects of the system bus. We run the test ten times and report the average timing for a BitBlt raster operation.

■ **The Memory-to-Screen BitBlt test** uses the *Windows* BitBlt function to move data from system memory to screen memory. It performs a number of *Windows* raster operation functions to manipulate bitmaps while performing BitBlt operations. This test measures the efficiency of the *Windows* driver as it transfers bitmap data across the system bus. We run the test

ten times and report the average timing for a BitBlt raster operation.

■ **The Random Rectangles test** measures the time it takes the graphics adapter and driver to draw a series of random rectangles, which is a common *Windows* operation, similar to erasing the background of a window or drawing title bars and menus. We run the test ten times and report the average time required to draw a rectangle.

■ **The Dialog Boxes test** generates and erases a *Windows* dialog box by using the *Windows* CreateDialog and EndDialog functions. Creating dialog boxes is a common *Windows* function. We run the test ten times and report the average time required to generate and erase a dialog box.

■ **The Aligned-Text Scroll test** scrolls aligned text down an on-screen window. This is similar to scrolling a *Windows* help screen, word processing file, or spreadsheet. We run the test ten times and report the average time required to scroll one screen of text.

■ **The Nonaligned-Text Scroll test** scrolls nonaligned text down an on-screen window. We run the test ten times and report the average time required to scroll one screen of text.

■ **The Rectangular Clipping test** performs clipping functions on text, lines, and bitmaps. In each case, an application is confined to the boundaries of a window and prevented from drawing outside it by clipping the application to the window area. We run the test ten times for each of the three types of clipping procedures, calculate the three average timings, and report the total of the three.

640-by-480 Resolution, 16 Colors

(Lower scores represent better performance)

	Aligned BitBlt Average Time (milliseconds)	Nonaligned BitBlt Average Time (milliseconds)
Genoa SuperVGA 6400VC	18.59	116.49
Ahead VGA Wizard/Deluxe 5.0	15.98	86.10
Focus 2 the Max VGA 4000	15.05	75.13
Micro Express VGA/72 Hz	14.49	68.64
SigmaVGA Legend	14.46	75.31
Cardinal VGA732	14.37	72.00
Micro-Labs Ultimate VGA/HiColor	14.37	69.21
Trident Impact III	14.35	85.32
Everex VRAM VGA	14.32	73.68
United Ultra-Image HiColor	14.29	68.46
Diamond SpeedSTAR HiColor VGA	14.27	68.15
STB PowerGraph Ergo-VGA	14.24	71.32
PCGC Photon Ultima Turbo	14.17	85.01
SOTA LightningVGA	14.16	66.96
Prism Excelsior	14.14	70.87
Boca SuperVGA	14.13	71.01
Orchid ProDesigner IIs	14.11	66.24
* Compaq Deskpro 386/25e	12.75	81.43
Desktop Quikdraw VGA	11.67	73.83
ATI VGA Integra	11.24	74.02
Video Seven VRAM II	10.91	69.70
ATI VGAWonder XL	10.12	69.28

640-by-480 Resolution, 256 Colors

(Lower scores represent better performance)

	Aligned BitBlt Average Time (milliseconds)	Nonaligned BitBlt Average Time (milliseconds)
Genoa SuperVGA 6400VC	198.46	199.21
Ahead VGA Wizard/Deluxe 5.0	179.70	179.62
Everex VRAM VGA	94.18	94.25
Prism Excelsior	87.80	87.85
PCGC Photon Ultima Turbo	68.27	71.36
ATI VGA Integra	61.34	121.48
Trident Impact III	61.15	66.47
Focus 2 the Max VGA 4000	39.18	76.06
ATI VGAWonder XL	37.28	37.93
SigmaVGA Legend	36.11	69.59
Cardinal VGA732	35.50	68.32
STB PowerGraph Ergo-VGA	35.37	68.36
Boca SuperVGA	35.10	67.77
Micro-Labs Ultimate VGA/HiColor	31.61	61.55
Diamond SpeedSTAR HiColor VGA	31.40	60.28
United Ultra-Image HiColor	31.26	59.77
SOTA LightningVGA	31.14	60.35
Orchid ProDesigner IIs	30.99	60.01
Micro Express VGA/72 Hz	27.79	53.36
Desktop Quikdraw VGA	22.58	45.50
Video Seven VRAM II	22.44	80.12

* Reported for comparison.

HARDWARE

SVGA GRAPHICS ADAPTERS

Integra. The Integra's score was not too bad on the Aligned BitBlt test but was relatively poor on all of the others—especially the Dialog Boxes test, where it took nearly three times as long as the fastest board.

In theory, aligned and unaligned BitBlt should require the same amount of time to complete in 256-color mode. In 16-color mode, each byte stores 2 pixels; thus, if 1 pixel in the byte has to move—as in a nonaligned BitBlt—intra-byte calcula-

tions are required. But in 256-color mode, each byte stores only 1 pixel, so aligned and nonaligned BitBlt performance should be equal. With most of the Tseng-based boards, this was not the case; nonaligned BitBlt operations took significantly longer. Tseng has now modified the driver set, and though we were unable to retest each board, we have verified that the new drivers correct the problem. Drivers dated later than 6/21/91 should include this change.

Among the non-Tseng-based boards, the Desktop and Video Seven boards use full 32-bit transfers for aligned BitBlt, and byte or word transfers for nonaligned BitBlt. This allows the aligned BitBlt operations to be anywhere from two to almost four times as fast as the nonaligned BitBlt. On the other hand, the Video Seven board's nonaligned BitBlt timing was not up to our expectations for a full 32-bit transfer.

Screen-to-Screen BitBlt Average Time (milliseconds)	Memory-to-Screen BitBlt Average Time (milliseconds)	Random Rectangles Average Time (milliseconds)	Dialog Boxes Average Time (milliseconds)	Aligned-Text Scroll Average Time (milliseconds)	Nonaligned-Text Scroll Average Time (milliseconds)	Rectangular Clipping Average Time (milliseconds)
114.11	87.70	5.67	421.20	17.14	36.11	1.49
88.17	66.65	4.64	366.33	14.37	31.57	1.38
81.52	60.64	4.84	354.39	13.54	30.59	1.40
74.96	56.74	4.78	341.95	13.52	30.55	1.43
82.17	59.65	4.78	350.58	13.49	31.52	1.40
77.38	58.68	4.79	350.95	13.55	30.57	1.41
76.12	58.22	4.86	347.23	13.53	30.43	1.45
87.30	67.21	4.86	378.13	13.43	30.53	1.44
79.79	59.18	4.76	348.22	13.49	31.47	1.42
75.71	58.07	4.58	330.29	12.96	31.23	1.38
76.32	58.79	4.76	341.35	13.48	31.45	1.43
77.42	58.72	4.80	350.95	13.45	30.56	1.37
88.53	68.14	4.90	377.92	13.50	31.75	1.43
71.79	54.60	4.73	335.26	13.40	26.16	1.36
76.10	57.79	4.77	345.42	13.24	30.05	1.37
77.57	59.07	4.76	346.10	13.37	31.41	1.36
72.32	59.72	4.76	354.20	12.97	27.84	1.29
88.63	66.93	4.48	366.80	12.00	30.05	0.95
75.80	58.94	4.25	346.86	10.98	23.69	1.34
78.15	59.94	4.07	343.33	10.80	23.78	1.30
74.60	57.92	3.88	328.64	10.34	23.99	1.28
72.49	56.05	3.87	337.02	9.94	22.55	1.32

Screen-to-Screen BitBlt Average Time (milliseconds)	Memory-to-Screen BitBlt Average Time (milliseconds)	Random Rectangles Average Time (milliseconds)	Dialog Boxes Average Time (milliseconds)	Aligned-Text Scroll Average Time (milliseconds)	Nonaligned-Text Scroll Average Time (milliseconds)	Rectangular Clipping Average Time (milliseconds)
1,202.52	182.03	16.96	752.89	161.94	161.93	4.31
474.38	162.61	15.16	741.67	148.52	148.68	5.07
963.92	147.39	10.21	578.12	76.44	76.63	3.72
641.21	144.13	22.55	516.90	73.57	73.70	3.66
125.49	141.88	10.66	580.63	59.52	62.44	4.17
337.38	392.74	8.66	1,135.09	55.92	107.45	4.08
120.68	141.58	10.09	573.29	54.01	57.93	4.03
633.00	134.10	6.65	564.04	36.06	64.78	3.72
72.11	133.48	6.36	512.90	35.46	36.36	3.75
829.45	130.43	6.49	539.95	34.02	59.60	3.65
630.60	131.60	6.71	547.90	33.33	58.83	3.79
636.06	131.64	6.64	547.16	35.22	58.40	3.75
623.48	130.15	6.64	543.01	32.61	57.92	3.72
629.65	131.19	6.57	533.39	30.46	54.02	3.70
622.35	129.59	6.49	525.68	30.08	53.91	3.62
622.29	129.55	6.43	527.55	30.12	53.98	3.64
595.52	129.61	6.45	525.88	29.93	54.04	3.68
616.44	133.64	6.35	539.71	29.42	54.92	3.55
627.69	129.21	6.43	521.05	26.98	46.38	3.65
142.41	140.11	7.85	382.25	21.30	21.61	2.30
110.79	109.58	6.48	438.98	22.94	23.55	3.74

ENDS

HARDWARE

SVGA GRAPHICS ADAPTERS

at text scrolling and rectangular clipping.

The results of the 800-by-600 256-color tests showed direct correlation to those of the 640-by-480 256-color tests, indicating that application speed and driver efficiency are keyed to the number of colors projected and not the resolution. Compared with 16-color drivers, 256-color drivers suffer from massive BitBlt programming overhead, as processing is performed through a compiler

and code is placed on the stack until called. Thus the 256-color BitBlt results are slower than the 16-color results.

The Desktop Quikdraw VGA and Video Seven VRAM II far and away surpassed the competition on most of the tests (although the Video Seven's Nonaligned BitBlt score was in the slower third of all the boards tested). Of the Tseng-based boards, the Prism and Everex again were

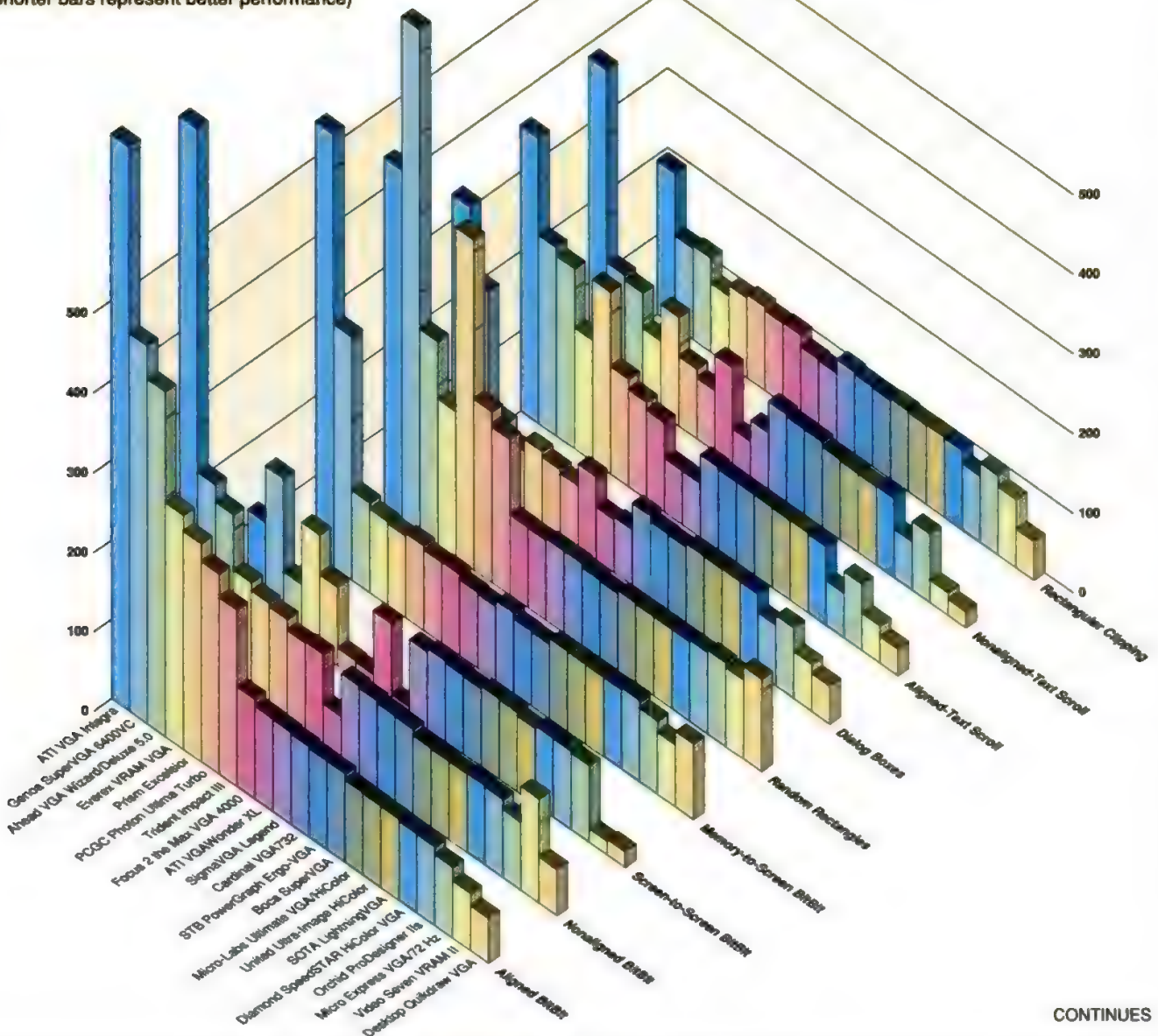
the slowest on nearly all tests, mimicking their results on 640-by-480 256-color tests. Clearly, the 256-color drivers leave something to be desired.

The Ahead VGA Wizard/Deluxe 5.0, ATI VGA Integra, and Genoa SuperVGA 6400VC were the slowest boards in nearly all categories. With only 512K memory, it is not surprising that the Integra had some of the slowest scores.

GRAPHICS PERFORMANCE TESTS FOR MICROSOFT WINDOWS, VERSION 3.0

800-by-600 Resolution, 256 Colors
(Shorter bars represent better performance)

Relative Times
(Diamond SpeedSTAR HiColor VGA = 100)



CONTINUES

HARDWARE

SVGA GRAPHICS ADAPTERS

PERFORMANCE TESTS: SUPER VGA GRAPHICS ADAPTERS

GRAPHICS PERFORMANCE TESTS FOR MICROSOFT WINDOWS, VERSION 3.0

**800-by-600 Resolution,
16 Colors**
(Lower scores represent
better performance)

	Aligned BitBlt Average Time (milliseconds)	Nonaligned BitBlt Average Time (milliseconds)	Screen- to-Screen BitBlt Average Time (milliseconds)	Memory-to- Screen BitBlt Average Time (milliseconds)	Random Rectangles Average Time (milliseconds)	Dialog Boxes Average Time (milliseconds)	Aligned-Text Scroll Average Time (milliseconds)	Nonaligned- Text Scroll Average Time (milliseconds)	Rectangular Clipping Average Time (milliseconds)
Genoa SuperVGA 6400VC	23.63	141.35	135.18	93.03	8.88	439.42	20.95	41.21	1.63
Ahead VGA Wizard/Deluxe 5.0	22.81	124.74	124.37	90.48	7.61	396.17	19.74	37.79	1.54
Focus 2 the Max VGA 4000	15.43	75.98	91.86	72.67	5.95	429.19	34.23	44.84	1.88
PCGC Photon Ultima Turbo	15.14	87.29	99.23	76.28	6.39	374.46	13.85	32.40	1.56
Cardinal VGA732	14.70	73.77	88.06	70.55	5.92	426.97	34.02	44.39	1.87
Micro Express VGA/72 Hz	14.48	69.22	84.48	69.09	6.37	398.43	33.87	44.37	1.86
Micro-Labs Ultimate VGA/HiColor	14.48	69.61	86.02	69.84	5.93	414.05	33.77	44.36	1.87
STB PowerGraph Ergo-VGA	14.44	72.59	86.80	69.82	5.93	424.45	33.76	44.27	1.87
United Ultra-Image HiColor	14.44	69.26	85.15	68.90	5.83	406.75	33.52	43.83	1.86
SigmaVGA Legend	14.41	76.20	91.85	72.07	6.28	346.49	13.45	31.54	1.48
Boca SuperVGA	14.34	72.06	86.05	69.48	5.81	420.07	33.35	43.62	1.84
Prism Excelsior	14.27	71.96	86.41	69.60	5.78	422.70	33.44	43.56	1.86
SOTA LightningVGA	14.23	67.51	81.15	66.03	5.80	404.89	30.49	38.03	1.83
Everex VRAM VGA	14.15	74.60	89.93	71.49	6.25	346.59	13.49	31.48	1.50
Orchid ProDesigner IIs	14.13	66.97	81.67	65.90	6.03	357.17	13.02	27.69	1.42
Diamond SpeedSTAR HiColor VGA	14.07	68.28	85.85	69.87	5.84	411.57	34.65	45.51	1.85
Trident Impact III	13.83	81.30	90.25	68.41	5.90	315.80	12.22	27.45	1.20
ATI VGA Integra	12.17	74.86	89.02	69.46	5.55	347.14	11.60	24.62	1.39
Video Seven VRAM II	10.94	70.23	83.85	66.52	4.81	333.42	10.40	23.63	1.34
ATI VGAWonder XL	10.07	69.08	81.87	65.34	4.84	331.80	10.00	22.69	1.35
Desktop Quikdraw VGA	9.36	65.63	76.39	62.07	4.35	320.62	9.35	21.60	1.31

**800-by-600 Resolution,
256 Colors**
(Lower scores represent
better performance)

	Aligned BitBlt Average Time (milliseconds)	Nonaligned BitBlt Average Time (milliseconds)	Screen- to-Screen BitBlt Average Time (milliseconds)	Memory-to- Screen BitBlt Average Time (milliseconds)	Random Rectangles Average Time (milliseconds)	Dialog Boxes Average Time (milliseconds)	Aligned-Text Scroll Average Time (milliseconds)	Nonaligned- Text Scroll Average Time (milliseconds)	Rectangular Clipping Average Time (milliseconds)
ATI VGA Integra	228.24	426.74	761.13	761.32	38.63	2,505.46	191.24	342.73	9.93
Genoa SuperVGA 6400VC	152.72	152.84	1,216.27	426.85	55.50	1,818.62	126.04	126.04	5.90
Ahead VGA Wizard/Deluxe 5.0	139.45	139.31	461.48	158.25	22.41	695.17	120.35	120.42	6.07
Everex VRAM VGA	94.72	94.82	964.76	147.84	16.14	549.21	80.89	80.86	4.45
Prism Excelsior	88.43	88.37	642.03	144.68	36.46	665.38	121.44	121.44	5.14
PCGC Photon Ultima Turbo	81.25	85.53	143.52	150.02	18.92	616.77	71.93	77.84	5.38
Trident Impact III	71.73	76.88	132.04	142.88	17.25	582.55	65.07	68.14	5.14
Focus 2 the Max VGA 4000	40.60	78.00	655.64	144.15	8.99	791.38	60.12	107.97	5.22
ATI VGAWonder XL	37.83	38.37	75.26	134.29	8.93	506.28	36.21	39.81	4.46
SigmaVGA Legend	37.62	72.60	625.43	131.24	9.14	530.39	36.06	63.75	4.37
Cardinal VGA732	36.97	70.75	654.63	142.06	9.12	781.71	55.44	98.95	5.28
STB PowerGraph Ergo-VGA	36.20	68.87	636.74	132.15	8.69	728.83	53.99	96.07	5.15
Boca SuperVGA	35.93	68.46	629.75	130.61	8.55	722.00	53.99	95.67	5.08
Micro-Labs Ultimate VGA/HiColor	33.39	63.60	652.24	141.40	8.92	755.85	54.02	89.96	5.22
United Ultra-Image HiColor	33.02	62.86	644.87	139.65	8.78	748.93	53.76	88.50	5.12
SOTA LightningVGA	32.83	62.42	619.40	139.33	8.77	752.96	53.97	87.96	5.16
Diamond SpeedSTAR HiColor VGA	32.16	63.50	645.14	139.86	8.80	753.09	53.32	89.35	5.13
Orchid ProDesigner IIs	31.82	62.33	639.85	143.03	8.97	577.71	30.27	54.93	4.27
Micro Express VGA/72 Hz	28.74	54.45	621.69	130.13	9.25	670.79	44.90	77.95	5.13
Video Seven VRAM II	23.26	82.90	112.73	110.09	8.74	443.54	25.11	25.55	4.39
Desktop Quikdraw VGA	18.31	36.79	129.38	134.17	10.25	357.23	17.92	18.46	2.52

ENDS



"My biggest client was using Novell. When I installed LANtastic, they thanked me for giving back their computers."

—Dennis Reese,
Reese Equipment Co.
Plymouth, Indiana



ARTISOFT SHATTERS THE MYTH

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WINNER
PC Magazine Award
for Best Network Software



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MAGAZINE
EDITORS'
CHOICE



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LANtastic shatters the myth that networks have to be an employment program for on-site computer technicians.

Out in Indiana farm country in 1988, Dennis Reese indulged his passion for computers by adding a room to his dad's farm equipment company. Last July, he started connecting his customers on LANtastic networks. Today that sideline is turning a million dollars a year.

His biggest client was running a 25-node network on one Novell system and preparing to upgrade to another. That's when Dennis installed Artisoft's LANtastic. "I told them if they didn't like it, I'd pull it out. No charge. Now they're the happiest customer I have. They really like having multiple servers with drives formatted for DOS. They thanked me for giving them back their computers."

LANtastic is so easy to use that Dennis's customers *enjoy* networking. The flexible peer-to-peer structure was another plus. "We have had many applications that bogged down on a client-server network. Now with LANtastic we can redistribute the processing to multiple servers."

Dennis' clientele are people more interested in being experts in their own fields rather than having to become—or hire—experts in an overcomplicated network. They are doctors, lawyers and industrial specialists like a large communications tower producer, a bearing manufacturer and a plastics firm that makes showers and tubs.

There's a myth that networks have to be an employment program for on-site computer technicians. Artisoft's LANtastic shatters the myth with a network that everyday people can install and understand and use with confidence.

"We will now turn down a network job if we are forced to install Novell. We tell people that our network is really called *FANtastic* and that Artisoft just can't spell."



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ORCHID TECHNOLOGY

**Orchid
ProDesigner IIs**

by John R. Quain

Rather than promising you one rainbow, Orchid Technology's new ProDesigner IIs offers you a choice of three. Replacing the popular full-length ProDesigner II card, the ProDesigner IIs is a three-quarter-length board with a socketed RAMDAC that can accommodate either a standard Samsung RAMDAC (\$349, with 512K of DRAM), a 32,768-color Sierra DAC (\$449, with 1MB of DRAM), or an Edsun CEG DAC (available as a \$99 upgrade kit). Further, no matter which option you choose, Orchid will take you to the graphics pot of gold faster, although more expensively, than most of the other Tseng-based boards in this roundup.

Utilizing the Tseng ET4000 chip set, the ProDesigner IIs offers all the same features of the ProDesigner II, as well as some improvements. Redressing shortcomings of the earlier model, the ProDesigner IIs now supports a Super VGA and VGA vertical refresh rate of 72 Hz (the older board only managed 56 Hz) and has DIP switches located on the mounting bracket so you no longer have to open the PC to make an adjustment. Maximum resolution is 1,024 by 768 pixels with 256 simultaneous colors and a 70-Hz vertical refresh rate (non-interlaced).

Orchid supplies an impressive number of software drivers to cover most business, DTP, and CAD applications (including a display-list driver for *AutoCAD*). In addition to the regular array of VMODE utilities supplied with Tseng-based boards, Orchid includes extended text modes, video BIOS acceleration (disabled for PC Magazine Labs' tests), and a rudimentary custom-font designer.

One ProDesigner II drawback that Orchid has not remedied with the ProDesigner IIs is the lack of VGA monitor support for older applications running in EGA, CGA, or Hercules video modes. If you want to run such applications and your VGA monitor cannot handle the lower horizontal frequencies required by those modes, you will have to spend \$25 for Orchid's optional translation ROM. This is a needless nuisance, since many less-expensive adapters give you this capability without making you spend extra money.

On PC Labs' *Microsoft Windows* performance tests, we tested the board with

the standard Samsung RAMDAC and 1MB of DRAM in zero-wait-state mode. In VGA modes the ProDesigner IIs performed below par under *Windows*. But in Super VGA modes the board delivered impressive performance. In both 16- and 256-color modes, it beat all 12 of the other Tseng-based boards in our roundup.

We separately tested the high-color Sierra and Edsun RAMDACs, with 1MB of DRAM installed. Among the tightly packed Sierra HiColor results, the Orchid was faster than most of the other Sierra-outfitted boards. However, at 32,768 colors in Super VGA mode, the Sierra RAMDAC's vertical refresh rate drops to an eye-straining 56 Hz. Orchid anticipates it will increase the vertical refresh rate of the Sierra-equipped version to 70 Hz by late summer.

Windows performance using the anti-aliasing Edsun RAMDAC generally looked very smooth, with the ragged edges in *Paintbrush* all but eliminated, for example. But there are still a few bugs in the *Windows* Edsun driver: mysterious dark bars moving at the edge of the image, occasional font smearing, and some moiré patterns when executing contiguous line draws. (The Genoa SuperVGA 6400VG experienced the same difficulties.)

The PC Labs *Windows* and VGA benchmark tests indicate that the Orchid ProDesigner IIs has a little growing to do before it blooms in VGA modes, but the socketed RAMDAC may be a good hedge against future performance and color upgrades. The preliminary documentation for the Edsun and Sierra upgrades is excellent, so users can pull chips like a technician (but if you require help from one, you will have to make a toll call). But even with the ProDesigner IIs' four-year parts-and-labor warranty, you can find a better performance value elsewhere.

Orchid ProDesigner IIs

Orchid Technology, 45365 Northport Loop West, Fremont, CA 94538; 415-683-0300.

List Price: With 1MB DRAM, \$449; Edsun RAMDAC upgrade kit, \$99. **In Short:** A new and improved Orchid offering, the ProDesigner IIs is outfitted with a high-color socketed RAMDAC (either Sierra or Edsun), but it also has a slightly high price and mostly average performance in VGA under *Windows*. In Super VGA modes, however, it beat all the other Tseng-based boards reviewed here.

CIRCLE 630 ON READER SERVICE CARD

PERSONAL COMPUTER
GRAPHICS CORP.**PCGC Photon
Ultima Turbo**

by Kellyn Betts

You will probably be unimpressed by the performance of Personal Computer Graphics Corp.'s \$445 Photon Ultima Turbo, but it possesses certain unique features which may interest you.

For starters, the Trident chip set-based board virtually guarantees flicker-free VGA DOS operation by running at 78 Hz from power-up. A company spokesperson assured us that this vertical refresh rate runs on 95 percent of all multiscanning monitors. PCGC, which sells through distributors, also actively promotes a 1,280-by-820 resolution at the tip of the card's capabilities.

The Photon Ultima Turbo's generous operating bandwidth also allows it to generate a 1,024-by-768-pixel resolution at 72 Hz. It also includes the ability to process TTL signals.

However, despite its bandwidth, the Photon Ultima Turbo's performance on PC Magazine Labs' *Windows* benchmark tests was uninspiring and a little erratic. Although it was in the top five on the 256-color VGA tests, its 16-color VGA test scores placed it deep among the slower boards. On the Super VGA tests it slightly trailed the leaders in 16-color mode.

An intriguing gee-whiz feature on the Photon Ultima Turbo appears because PCGC bundles these cards with its own personal computers. The video card contains an EEPROM chip that demands a password from PC users on boot-up. The chip can also hold a copy of a computer's CMOS setup to ease the pain of unexpected losses.

PCGC's computer line is aimed at CAD users. Accordingly, its video card comes with a propriety *AutoCAD* display-list driver that works in both real and protected modes, as well as a software package called *Birds Eye* for faster pans and zooms. PCGC also includes drivers for five other CAD packages.

The manuals that come with the Photon card are not great, but an included READ.ME file provides instruction, making setup smooth enough. The board comes with a two-year warranty on parts and labor and a 24-hour automated technical support line (it was down the night we tried it).

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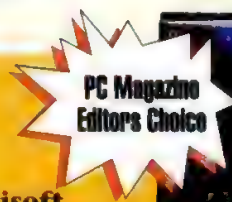


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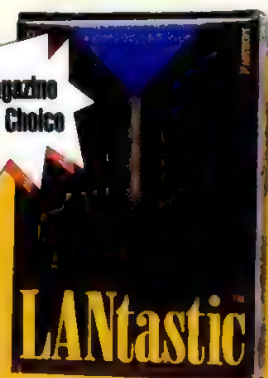
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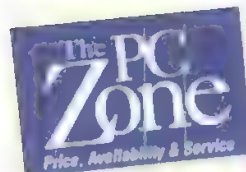
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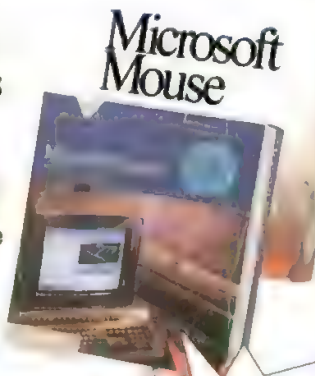
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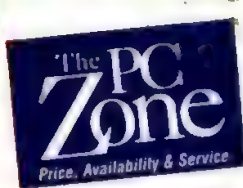
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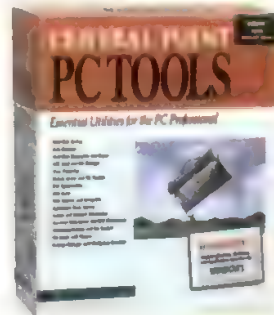
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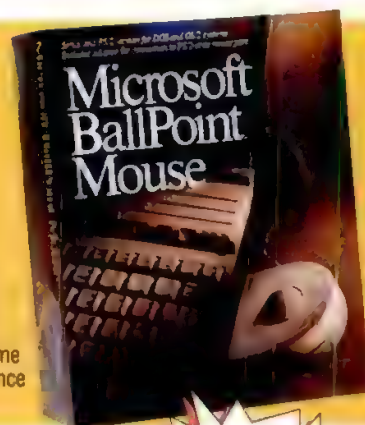
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Though it possesses some unusual features, the Photon Ultima Turbo's erratic performance in VGA mode and high price make this board difficult to recommend.

PCGC Photon Ultima Turbo

Personal Computer Graphics Corp., 3914-901 Delamo Blvd., Torrance, CA 90503; 800-255-9893, 213-214-0550. **List Price:** With 1MB DRAM, \$445; Edsun upgrade kit, \$50. **In Short:** Though it has a few interestingly different features such as password protection in an on-board EEPROM, the Photon Ultima Turbo's unimpressive performance and high price may make you look elsewhere.

CIRCLE 631 ON READER SERVICE CARD

beyond two or three years. The Excelsior is definitely high tech and just as definitely functional, but it misses the cutting edge.

Prism Excelsior

Prism Imaging Systems, 5309 Randal Pl., Fremont, CA 94538; 415-490-9360. **List Price:** With 1MB DRAM, \$495; with Sierra RAMDAC, \$595. **In Short:** Although it comes with many drivers, the rest of the Excelsior's package is weak, while the board's performance and price are also uninspiring.

CIRCLE 632 ON READER SERVICE CARD

SIGMA DESIGNS

SigmaVGA Legend

by Winn L. Rosch

Where other Super VGA makers stop, Sigma Designs starts. With a maximum 1,024-by-768 resolution (interlaced or noninterlaced) with 256 simultaneous on-screen colors from a palette of 256,000, the SigmaVGA Legend is the company's bottom-of-the-line board. Perhaps as a result, the Legend works best at higher resolutions and is average at the VGA level, but is distinctly peppier when resolution reaches 800 by 600 pixels. Listing for \$359, it falls in the middle of the pack.

What you get is a 7-inch-long board decked out with a Tseng Laboratories ET4000AX VGA chip, a proprietary ROM BIOS, a generic VGA RAMDAC, and 80-nanosecond DRAM memory. Sockets are available on the 512K version of the board so you can upgrade it to 1MB, which is how we tested it. Sigma includes a VGA feature connector and a VGA-style 15-pin high-density D-shell connector for analog monitors.

Although slightly more complex than the best Super VGA products when it comes to software setup, the Legend was easy to get going. It requires only one adjustment: setting a jumper for normal VGA synchronizing frequencies or "ergonomic" vertical refresh rates of 88 Hz in VGA text and graphics modes (except for 640 by 480, which runs at 72 Hz, as do VESA modes).

To properly match the board to the monitor so the board knows what frequencies to use, you must load a driver file through your AUTOEXEC.BAT file. Driver installation and diagnostics are automated through a setup program, and a

utility allows you to select the operating mode via the command line (or batch file). It also incorporates a screen-saver. Another utility lets you move the display BIOS from ROM to RAM. VESA software compatibility is achieved through a 1.3K TSR add-on BIOS program.

In standard VGA mode, the Legend was an unremarkable and even below-average performer. By using Sigma's drivers for a wider spectrum and higher resolutions, the Legend moved up against the competition, scoring as high as third place in rectangle clipping at 800-by-600 resolution with 256 colors. The Legend is not remarkable, but it is not unacceptably slow.

The Legend includes all the drivers you should expect (except *Lotus 1-2-3*, Release 3.x), and an electronic bulletin board is available for quick upgrades. The board is backed by a five-year parts-and-labor warranty and a business-hours-only technical hotline.

Although the SigmaVGA Legend may not be something to tell your grandchildren about, you probably won't tell tales of regret after plugging one into your PC.

SigmaVGA Legend

Sigma Designs, 46501 Landing Pkwy., Fremont, CA 94538; 415-770-0100. **List Price:** With 1MB DRAM, \$359. **In Short:** At its best at higher resolutions, the SigmaVGA Legend is an average performer that provides VESA and Super VGA capabilities up to 1,024 by 768 in 256 colors. It is marred, however, by the need for software drivers to work its advanced modes.

CIRCLE 633 ON READER SERVICE CARD

SOTA TECHNOLOGY INC.

SOTA

LightningVGA

by Winn L. Rosch

Although SOTA Technology's name for its second video product, the LightningVGA, might make you think it is a flashy performer, this board is better bought for versatility and resolution rather than pure speed. It is state-of-the-art (hence the acronym SOTA), but the better-than-average LightningVGA rarely scores top honors.

In fact, if what you're looking for is pure speed, even SOTA would recommend you forgo the \$445 LightningVGA for its faster sibling, the Texas Instruments

PRISM IMAGING SYSTEMS

Prism Excelsior

by Bill O'Brien

Carrying 1MB of DRAM and a Tseng Laboratories chip, Prism Imaging Systems' \$495 price tag for its Excelsior board is distinctly high tier. The board performs as advertised but lacks some of the superlatives that might confirm its pricey position.

The Excelsior's weak links are oversight and omission. With drivers for OS/2, *AutoCad* 10 and 11, *Cadkey*, *Generic Cad*, *Microsoft Windows*, *Micro Station*, *PCad*, and *VersaCad*, as well as the various utilities, diagnostics, and a VESA-compatibility TSR, you will find yourself hunting among the ten diskettes provided whenever you need to install a driver. An automatic installation program would be appreciated for more than just the utilities. Not having one makes your initial encounter with the Excelsior tedious.

The Excelsior quickly exonerates itself once you install the *Windows* driver files, however. Its performance at 800 by 600 in both 16 and 256 colors was typically average for the group, with only its *Windows* scrolling times (both aligned and non-aligned) as disappointments. In 640-by-480 mode with 256 colors, its Random Rectangles test scores added to its list of woes, but the board settled down completely at 16 colors. PC Magazine Labs' DOS-based VGA tests provided results that were equally as typical until they reached the Excelsior's BIOS functions, which were also below par.

Prism's lifetime warranty on the Excelsior is a major bonus for the card, but with video standards changing every few years, the card's useful life may not extend much

HARDWARE

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TMS34010-based SOTA 340i, a coprocessed board that retails at \$995.

Beyond the 800-by-600 and 1,024-by-768 resolutions offered by most Super VGA boards, the LightningVGA adds both 1,152-by-900 and 1,280-by-1,024 resolutions (the latter is noninterlaced, but it operates at an eye-wearying 49-Hz vertical frequency). It supports all VESA Super VGA standards and guidelines as well as text modes up to 132 columns by 44 rows.

The LightningVGA is a rather big board, measuring ten inches long and full XT-height. It also features a 16.7-million-color palette, 32,768 of which can be simultaneously displayed on-screen at 800-by-600 resolution; the adapter can display 256 simultaneous colors at higher resolutions.

This wide color spectrum is a product of the LightningVGA's Sierra HiColor RAMDAC, which is complemented by a Tseng Laboratories ET4000AX Super VGA chip and a Tseng BIOS with EPROM-based VESA support. When we tested the evaluation unit, however, this combination exhibited a number of compatibility problems. For example, it randomly moved screen elements in PC Magazine Lab's *Microsoft Windows* benchmark tests. According to a factory spokesperson, these bugs have been swatted with a BIOS upgrade.

The board excelled using SOTA's own 640-by-480 16-color driver with *Windows*, scoring first in two out of four BitBlt tests. The LightningVGA placed second on one test at 800-by-600 mode with 16 colors. Most of the time it delivered above-average performance, dawdling slightly below average only in interface tests at the 800-by-600 256-color level.

The base-priced \$395 version of the LightningVGA includes 512K of standard memory in the form of 4-by-256K 80-nanosecond DRAM chips. Four ZIP sockets let you upgrade the board to 1MB. In addition, an area of unused solder pads at the end of the board may allow SOTA to factory-pack the board with eight VRAM chips in the future. Two expansion sockets—a 28-pin DIP and a 44-pin PLCC—await future upgrades such as an optional bus-mouse output.

Both VESA (pin-style) and VGA (edge-style) feature connectors are available for expansion. The sole monitor connection is a 15-pin high-density D-shell for analog displays.

Setup requires you adjust an internal eight-bank DIP switch, which selects op-

erating frequencies and monitor type. Although the preliminary documentation supplied with the evaluation board made that a challenge, a business-hours-only technical hotline is available, as is a bulletin board.

The LightningVGA includes a wealth of software drivers, including those for many CAD programs and a display-list



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driver for *AutoCAD*. The board is backed by a five-year parts-and-labor warranty. If you don't mind parting with the money, choose the SOTA LightningVGA for its advanced resolutions, good performance, and extra features—after its bugs die off, that is.

SOTA LightningVGA

SOTA Technology Inc., 559 Weddell Dr., Sunnyvale, CA 94089; 800-933-7682, 408-745-1111. **List Price:** With 1MB DRAM

and Sierra RAMDAC, \$445. **In Short:** The LightningVGA is a Super VGA board with above-average performance and the additional benefits of extra high-resolution modes (up to 1,280 by 1,024) and realistic color capabilities (32,768 colors from a palette of 16.7 million). Its price is a bit high, however.

CIRCLE 634 ON READER SERVICE CARD

STB SYSTEMS INC.

STB PowerGraph Ergo-VGA

by Winn L. Rosch

The "Ergo" in the name of STB Systems's PowerGraph Ergo-VGA tells the most important part of this board's story. It is the company's first ergonomic display adapter that meets VESA's 72-Hz vertical refresh rate at 800- by 600-pixel resolution. The PowerGraph fits at the top of the company's eight-product VGA lineup that starts with the \$129 AutoVGA/16, although it delivers only average *Microsoft Windows* performance.

Even in its privileged position at the top of the line, the PowerGraph is close to being a commodity Super VGA board. Its price is just above no-name products—\$315 (retail with 1MB of DRAM, about \$250 on the street). A Micro Channel version, available in July, is less of a bargain at \$459.

Based on the Tseng Laboratories ET4000AX Super VGA chip, the PowerGraph uses STB's own BIOS and a garden-variety Samsung RAMDAC on the evaluation board. However, an optional \$60 will buy a Sierra HiColor RAMDAC and drivers for 32,768-color operation, or \$60 extra will put an Edsun CEG chip on the board for 792,096 colors. With the standard RAMDAC, 256 simultaneous colors are available from a palette of 262,144 all the way to the board's top 1,024-by-768-pixel resolution. It also supports 132 columns and 60 rows of text.

Note that the PowerGraph's 1,024-by-768 resolution uses unusual synchronizing frequencies: 61 kHz horizontal and 75 Hz vertical. While these will give less flicker than the more-common 48-kHz and 60-Hz combination, taking advantage of them may require a more costly monitor. The board will also work with an 8514/A-compatible monitor, but in this case you hopefully do not mind interlacing.

Eight DIP sockets, available for memory chips, were filled with 70-nanosecond 4-by-256-kilobit DRAM chips. STB offers a \$265 512K version and a \$239 256K version of the board.

The 16-bit board measures just 7.5 inches long and is XT-height. A VGA feature connector cuts into the top, and a 15-pin high-density D-shell is available on the rear panel to connect it to analog monitors.

Hardware setup involves only three jumpers. In most cases you will only need



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* The Cardinal VGA742 performed over two times faster than the leading competitive models in more than 2/3 of PC Labs Windows Benchmark (version 1.1) tests.

to adjust the one that selects between 60- and 72-Hz vertical refresh rates at the 800-by-600-pixel resolution level.

Running PC Magazine Labs' *Microsoft Windows* benchmark tests, the PowerGraph did not distinguish itself. All its scores save one (random rectangle drawing in 800-by-600-pixel, 256-color mode), grasped tenaciously to the average. Even on its exceptional score, it only placed second. At the DOS prompt the board delivered average performance. Its scores on our VGA tests were in keeping with other Tseng-based boards.

On the positive side, a full assortment of drivers are available for the PowerGraph, including a display-list driver for *AutoCAD*. You can get more drivers from STB's electronic BBS. The PowerGraph is backed by a two-year warranty and toll-free support during business hours.

With mediocre performance and a price that is right in the middle of the pack, the STB PowerGraph Ergo-VGA is an undistinguished product. Its chief advantage is the ability to upgrade to a full-color RAMDAC. Buy it only at a favorable price.

STB PowerGraph Ergo-VGA

STB Systems Inc., 1651 N. Glenville,

#210, Richardson, TX 75081; 214-234-8750. **List Price:** With 1MB DRAM, \$315; Edsun RAMDAC upgrade, \$60; Sierra RAMDAC upgrade, \$60. **In Short:** With just average performance, the PowerGraph Ergo-VGA is a commodity Super VGA board that is best chosen at a favorable price or if you need the capability to upgrade to Edsun or Sierra RAMDACs.

CIRCLE 635 ON READER SERVICE CARD

TRIDENT MICROSYSTEMS INC. *Trident Impact III*

by Winn L. Rosch

Trident Microsystems's *Impact III* is an average product in the three main categories: price, performance, and drivers. Although the \$295 (about \$220 on the street) board with 1MB of DRAM does not win top honors in any category, its virtues make it a decent value.

The 7.25-inch board is XT-height except for a small EISA-compatible skirt between the 16-bit edge connector and the

card-retaining bracket. It is based on Trident's own TVGA8900C VGA chip, a Quantel BIOS, and a conventional VGA RAMDAC (a Samsung chip on the evaluation board). The board handles VGA, Super VGA, and 1,024-by-768 resolutions with a maximum of 256 simultaneous colors drawn from a palette of 262,144. It displays text with up to 132 columns and 60 rows.

If you have a tight budget, you can buy the *Impact III* with as little as 256K of RAM for \$195 or with 512K for \$229. Moreover, you can fill its six sockets with 4-by-256 kilobit fast-page-mode 100-nanosecond DRAM chips if you don't mind interlacing at the board's highest resolution. Chips rated at 80 ns., like the two soldered down on every board, are required for noninterlaced operation. A VGA feature connector is available for expansion, as is a single 15-pin high-density D-shell for monitor connection.

The available memory options complicate hardware setup, requiring you to set jumpers in order to match chips to the board. A DIP switch, accessible through the card retaining bracket, allows you to select the synchronizing frequencies output to your monitor.

For true VESA compatibility the *Impact III* requires you load a TSR program that steals about 7K of DOS memory. To improve performance, Trident supplies both a driver loaded through CONFIG.SYS and a utility designed for loading through AUTOEXEC.BAT (one or the other, not both) to move the board's BIOS from slow ROM to fast RAM. In addition to one of the lengthiest list of drivers around, Trident includes a mode-switching utility and replacement for ANSI.SYS with extended-mode capability. Trident includes an extra font to make control buttons bigger when running *Microsoft Windows* in high-resolution modes.

The *Impact III* appears to favor its own drivers; for example, it scored in the middle (twelfth out of 21) when drawing dialog boxes using the standard *Windows* VGA driver, but it scored in first place when using Trident's own 800-by-600-pixel 256-color driver. Most of the *Impact III*'s scores similarly fluctuated above and below the average, with better scores under *Windows* than DOS tests. On the whole, you should expect it to be an unremarkable performer.

The *Impact III* is backed with a two-year warranty, a business-hours-only technical hotline, and an electronic bulletin

LOOKING FOR



HARDWARE

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board. With no bad habits, acceptable performance, and a below average price, the Trident Impact III is an okay choice for VESA-compatible Super VGA displays.

Trident Impact III

Trident Microsystems Inc., 321 Soquel Way, Sunnyvale, CA 94086; 800-348-8808, 408-738-3194. **List Price:** With 1MB DRAM, \$295; with Edsun RAMDAC, \$395; with Sierra RAMDAC, \$349. **In Short:** The affordable Impact III, though average in performance, is blessed with a wide range of drivers and cursed by the need for software-mediated VESA compatibility.

CIRCLE 836 ON READER SERVICE CARD

UNITED SOLUTIONS **United Ultra-Image HiColor**

by Kellyn Betts

The \$199 United Ultra-Image HiColor, one of the least expensive cards in this review, is favored with not only solid performance but high color as well. At a street price of about \$179, this adapter is a bargain worth investigating.

Like twelve other boards reviewed in this issue, the Ultra-Image utilizes Tseng Laboratories' ET4000 chip set. The Tseng chip set was so new at review time that United Solutions was not even able to send us a board with its own name stenciled on it. The documentation provided with the card was also unlabeled and completely generic, and like the card's stencil, the *Microsoft Windows* drivers bore the Tseng name.

Certainly, by the time this is published, the company's products should be more personalized. In the meantime, however, the Ultra-Image is a rather generic Tseng-based board. Its performance scores were all strikingly similar to those of some of its competitors on PC Magazine Labs' VGA and *Windows* benchmark tests.

This card does, however, offer significantly better performance than most of the other Sierra HiColor RAMDAC cards on PC Labs' high-color tests. Like most of the cards with the Tseng chip set, the Ultra-Image performs better under *Windows* with 256-color drivers loaded and did better on the screen-moving and low-resolution VGA tests than on the high-color tests. The Ultra-Image can support up to 1,280 by 1,024 pixels (at interlaced 87 Hz) and can handle VGA and Super VGA at

the VESA-recommended 72-Hz vertical refresh rate while managing 1,024 by 768 at a 70-Hz maximum refresh rate.

Using its generic out-of-date manual, the United Solutions card was easy enough to set up. And its lifetime replacement warranty is nothing short of amazing, considering the product's other attributes. Ditto for the 800-number technical hotline and CompuServe bulletin-board service.

For price, performance, service, and support, United Solutions' Ultra-Image HiColor is unquestionably the best buy to be found today among VESA-compliant video adapters. It almost seems too good to be true.

United Ultra-Image HiColor

United Solutions, 6382 Arizona Circle, Los Angeles, CA 90045; 800-365-4995, 213-645-3232. **List Price:** With 1MB DRAM, \$199; without Sierra RAMDAC, \$179. **In Short:** The Tseng-based Ultra-Image HiColor comes with an excellent price, solid performance, and even a Sierra HiColor RAMDAC. As soon as its package matures, it will be well worth consideration.

CIRCLE 837 ON READER SERVICE CARD

VIDEO SEVEN/HEADLAND
TECHNOLOGY INC.

Video Seven VRAM II

by John R. Quain

With the \$499 Video Seven VRAM II, Video Seven/Headland Technology maintains its reputation as a leader in the Super VGA adapter market. Eschewing the pervasive Tseng Laboratories ET4000 chip, Video Seven uses its own VGA controller, an INMOS RAMDAC, and 1MB of dual-ported VRAM. Its supercharged performance and substantial price are largely due to expensive VRAM, but you can find it through mail-order for \$470.

Continuing to develop its own chip set, Video Seven enjoys a solid following in the VGA adapter arena (eroded only slightly by the invasion of Tseng-based boards), and the VRAM II represents the pinnacle of the Video Seven's non-coprocessed offerings. If your monitor can handle it, this analog-only graphics adapter will push the screen out to 1,024- by 768-pixels with 256 colors and a vertical refresh rate of 60 Hz (noninterlaced). Faster



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72-Hz refresh rates can be squeezed out not only in noninterlaced 800-by-600 mode (16 or 256 colors) but also in the standard VGA mode with 256 colors.

Utilities bundled with this board include menus to choose or adjust particular enhanced graphics and text modes, with vertical and horizontal size adjustment possible via the cursor keys. Users can even customize and store settings for a particular monitor. To reach the 72-Hz Super VGA VESA-compliant refresh rate, Video Seven uses a 5K TSR. If you want to hasten the board's already speedy performance, there is a utility to copy the video BIOS into system RAM, but it takes 24K of conventional memory. The VRAM II is also software compatible with such older graphics standards as EGA, CGA, and Hercules.

Software installation is menu driven, though a lack of prompts and absence of numbers on the install disks caused some confusion during setup. Extensive application drivers for most popular business, DTP, and CAD software are supplied, including OS/2 PM, *VersaCAD*, and a display-list driver to quicken the pace of *AutoCAD*. Usually installation is a switch-

less affair, but when the need arises, you can access the DIP switches at the back of the board without opening up the PC.

The VRAM II really lit up the monitor's phosphors in PC Magazine Labs' *Microsoft Windows* benchmark tests when it ran in Super VGA mode with 256 colors and a 72-Hz vertical refresh rate. Pixel throughput pulled the VRAM II ahead of all the other boards reviewed here except for the Desktop Quickdraw VGA, which gave it a close race. In 800-by-600 mode with 16 colors, the VRAM II was not quite as fleet but managed to stay in the running with the top four or five boards.

Raising the color demands to 256 in standard VGA mode again turned the *Windows* benchmark tests into a drag race between the Desktop Quickdraw VGA and the Video Seven VRAM II. Though the Quickdraw crossed the line first, it was a photo finish. However, using the most common mode for business applications—16 colors at a 640-by-480-pixel resolution—the leaders pushed the Quickdraw into fourth place, while Video Seven's VRAM II managed to stay in second.

If pure speed is not enough to make you reach for your wallet, Video Seven's warranty coverage should: seven years, including parts and labor. When servicing is required, you can reach the company via a BBS, fax, or a toll-free phone call. For those who appreciate the board's sporty looks but cannot afford the horsepower, Video Seven/Headland offers the VRAM II with 512K (limited to 16 colors in 1,024-by-768-pixel resolution) for \$399. ■

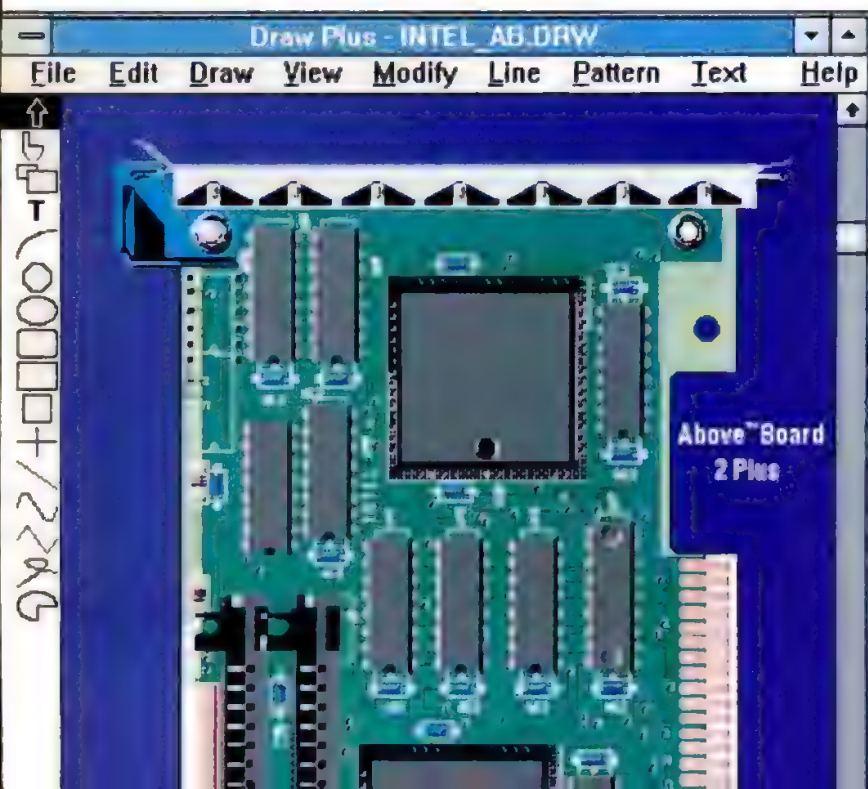
EDITORS' CHOICE

Video Seven VRAM II

Video Seven/Headland Technology Inc., 46221 Landing Pkwy., Fremont, CA 94538; 800-238-0101, 415-623-7857. **List Price:** With 1MB VRAM, \$499. **In Short:** A Super VGA adapter with the ability to burn rubber, the Video Seven VRAM II's speedy performance is rivaled only by the Desktop Quickdraw VGA. Even with a street price of \$470, the VRAM II's combination of a Headland controller, INMOS RAMDAC, 1MB of VRAM, extensive utilities, and a seven-year warranty make it the one to beat.

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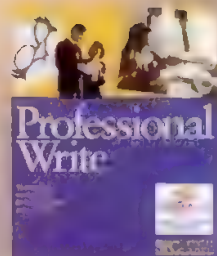
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15 Writers' Tools

We've graded 15 writers' tools on their ability to help you master the English language—quirks and all. They'll help you find the exact word you want, tell you what it means, and show you how to use it correctly.

by Rubin Rabinovitz

English is an eccentric language. Its grammar is illogical, pronunciations are often unreasonable ("cough" rhymes with "off" but not with "bough"), and the semantics are unpredictable: An innocent-looking word like "set" can have a hundred different definable meanings. Its spelling is bazaar—er, bizarre. These examples only hint at the numerous headaches that face those who develop writers' tools, the programs designed to help writers cope with style, grammar, vocabu-

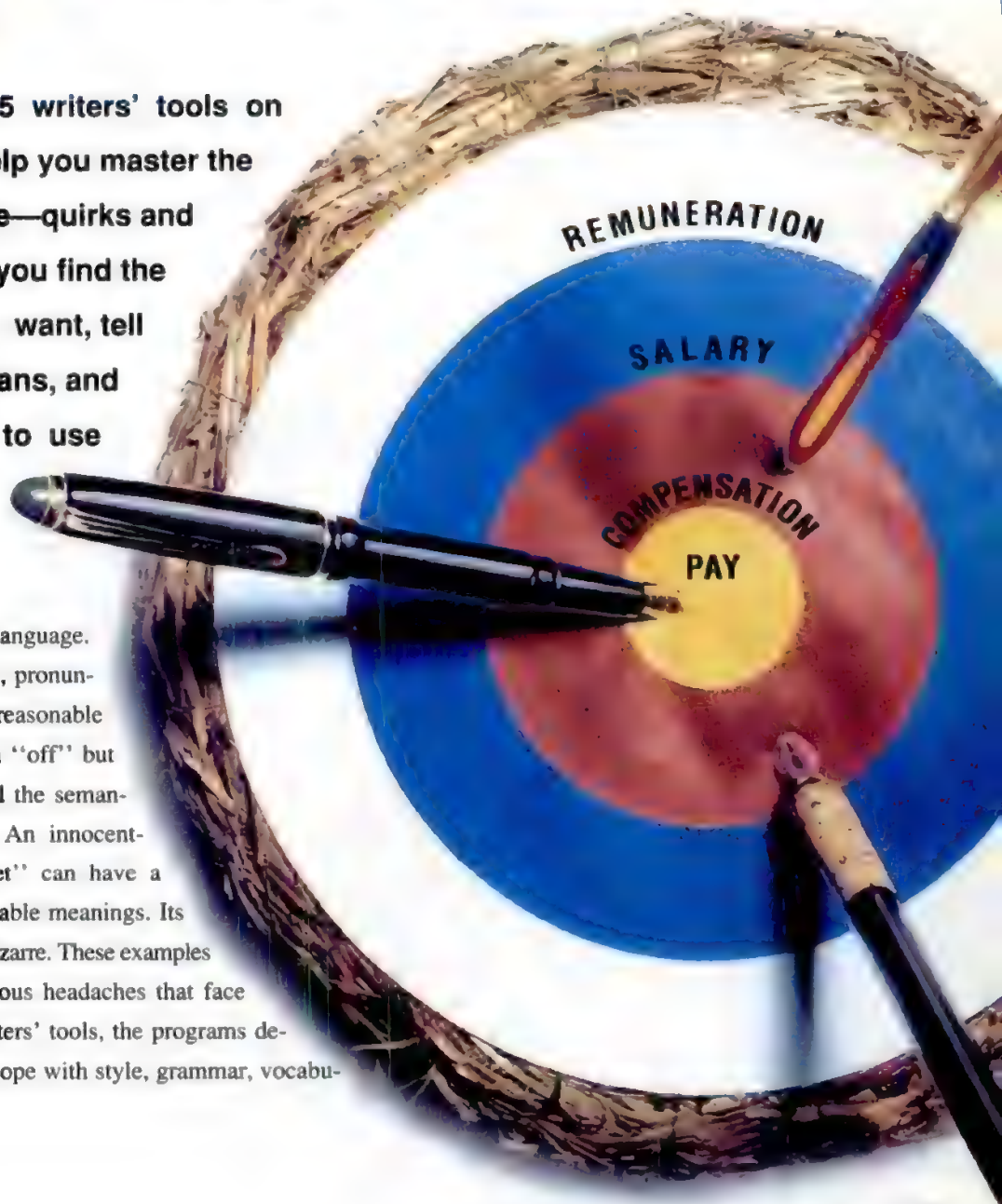


ILLUSTRATION: GLENN DEAN

lary, spelling, and research.

In this roundup we've evaluated 15 writers' tools ranging in price from \$14.95 to \$295 that you'll find useful—grammar checkers, thesauruses, dictionaries, and combinations—and put them through a battery of tests. Some packages perform a single function, some are multipurpose packages, and others are bundled with style manuals, quotation dictionaries, and business-letter software.

If you own a good word processor, it already has an integrated spell-checking program, and since just about any integrated spell-checker is more efficient than a separate add-on product, we do not evaluate spell-checkers here. If your word processor does not include one, check the "Standard Equipment" table to find out which word processors do. We did evaluate the spell-checkers that come with grammar programs because they correct spelling and grammar errors in a single pass.

GRAMMAR CHECKERS: FACT AND FICTION

If you've ever worried that your computer is smarter than you are, try spending some time evaluating grammar checkers. The sad truth is that they aren't very effective programs: On our performance

tests, the program that did the best job catching errors—Artificial Linguistics' *PowerEdit*—spotted only about 50 percent of the mistakes. It's not that grammar checkers are poorly designed; in fact,

**In the final analysis,
grammar checkers
may be most valuable
as tools to create
style rules for your
organization.**

they're very sophisticated programs. The problem is that parsing sentences correctly is such a complicated task. When you have to be unequivocally, unquestionably certain that a document is error-free, nothing can take the place of a skilled human editor.

In the final analysis, grammar checkers may be most valuable as tools to create style rules for your organization.

Then you can use them to maintain style standards in your memos, documents, and correspondence. All the packages we looked at do a good job of this.

FINDING THE RIGHT WORD

You'll see all kinds of claims for the number of words in an electronic thesaurus; different publishers take different approaches to measuring their lexicons, and some claims may be inflated. Our tests indicate that the best electronic thesauruses—*Franklin Electronic Thesaurus* and *Word Finder*—give you about 60 to 70 percent of the information you'd get in a printed desk thesaurus. Only you can decide if the convenience is worth the loss of information.

If you're dissatisfied with the electronic thesaurus that came with your word processor, you can supplement it with a standalone program. *Word Finder* and thesauruses based on the Merriam-Webster thesaurus work well in tandem because they often provide different synonyms. But be sure that you know which thesaurus is integrated with your word processor; you do not want to end up with a renamed version of a program you already own (see the sidebars "Standard Equipment" and "A Tangle of Tools").

Most of the writers' tools we tested



STANDARD EQUIPMENT: THE WRITERS' TOOLS INCLUDED IN THE WORD PROCESSORS YOU USE

	Ami Professional	DisplayWrite	Microsoft Word	Microsoft Word for Windows	MultiMate	Professional Write
Grammar checker	☐	☐	☐	☐	☒	☒
Source of grammar checker	N/A	N/A	N/A	N/A	Grammatik IV	Grammatik IV
Dictionary	☐	☒	☐	☐	☒	☐
Source of dictionary	N/A	Proprietary	N/A	N/A	Proximity	N/A
Number of words	N/A	120,000	N/A	N/A	110,000	N/A
Thesaurus	☒	☒	☒	☒	☒	☒
Thesaurus is integrated with dictionary or spell-checker	☐	☒	☐	☐	☒	☒
Source of thesaurus	Proximity	Roget	Soft-Art	Houghton- Mifflin	Proximity	Soft-Art
Number of root words	40,000	60,000	21,456	70,000	40,000	20,000
Provides antonyms	☒	☐	☐	☐	☐	☐
Spell-checker	☒	☒	☒	☒	☒	☒
Source of spell-checker	Soft-Art	Proprietary	Soft-Art	Soft-Art	Proximity	Soft-Art
Number of words in spell-checker	130,000	120,000	130,000	130,000	110,000	77,000
Customizable	☒	☒	☒	☒	☒	☒
Option to check spelling as you type	☐	☒	☐	☐	☐	☐
Specialized spell-checkers available	Foreign	Legal, medical, foreign	Legal, medical, foreign	Legal, medical, foreign	Legal, medical	None

☒—Yes ☐—No

N/A—Not applicable: The product does not have this feature.

seem to have been carefully checked for accuracy, but a few aren't dependable. In particular, some thesauruses are indiscriminate in the way they equate apparent synonyms. For example, one program gave "empress" as a synonym for "czar"; another equated "satisfy" with "induce." Happily, the thesauruses that received the best scores on our tests were also the most reliable.

FOOD FOR INFORMATION JUNKIES

Electronic reference works aren't necessarily an improvement over their printed counterparts. A book may be easier to use and will certainly be cheaper. Conversely, a good retrieval engine can dredge up information from a large database quickly. This is one reason why electronic dictionaries and encyclopedias are often more useful than smaller programs such as style manuals.

To address this problem, some electronic publishers use appendixes with different kinds of information to fill out their style manuals. For example, *Resident Expert for Effective Writing* from Parsons Technology supplements a style manual with a word-division dictionary and a 190K almanac that covers geography, history, language, computers, mathematics, and science.

The dictionaries and encyclopedias we've looked at are all very good research tools. They have efficient retrieval engines and databases large enough to warm the heart of an information junkie. Most of these packages are new, however, and plagued with minor annoyances such as a lack of speed or cantankerous TSR modules. As they are revised, such imperfections will probably be eliminated. For now, we have included warnings about any glitches found in the individual programs.

BUNDLED PROGRAMS:

HOW GOOD A BUY?

Should you buy standalone programs or a package deal like *The Complete Writer's Toolkit* or *The Writer's Pack* that includes a number of distinct writing tools? The good news is that a bundled package saves you money; the bad news is that the programs you get are seldom of equal quality. Thus the top-rated *American Heritage Dictionary* comes with the third-ranked thesaurus, and the top-rated *Franklin Webster Electronic Thesaurus* comes with the third-ranked dictionary.

The following is a small sample of the

A TANGLE OF TOOLS

Many of the writers' tools reviewed in this issue are related to products with different names. Some products are virtually identical, sharing certain features, and others are bundled in collections of writers' tools. This list helps you make the distinctions among packages.

The American Heritage Electronic Dictionary has a lexicon similar to the one in *Definitions Plus*.

The Complete Writer's Toolkit contains *CorrecText*, *The American Heritage Dictionary*, *Roget's II Thesaurus*, *Concise Columbia Dictionary of Quotations*, *Houghton Mifflin's Abbreviation Program*, and *Written Word III*.

Correct Grammar includes a version of Houghton Mifflin's *CorrecText*.

Definitions Plus has a lexicon similar to the one in *The American Heritage Electronic Dictionary*.

Electric Webster uses the same spell-checker as *Whoops!*.

Franklin Language Master contains the Merriam-Webster dictionary and thesaurus developed by Proximity Technology.

Infodesk A series of separately sold programs that includes *The Random House Encyclopedia*, *Inside Information*, and *The Elements of Style*.

Key Grammar Checker is a version of Que Corp.'s *RightWriter*, which is sold by SoftKey.

KeyNotes Writer's Handbook is included in *The Writer's Pack*; it is not related to other products with the name *Key*.

RightWriter is also sold by SoftKey as *Key Grammar Checker*.

Webster's Concise Electronic Dictionary is included in *Franklin Language Master*.

Webster's Electronic Thesaurus is included in *Franklin Language Master*.

Webster's New World Thesaurus, from Simon and Schuster, is no longer available and is not related to other thesauruses using the name *Webster*.

Whoops! uses the same spell-checker as *Electric Webster*.

The Writer's Pack is a bundled package from Reference Software that contains *Grammatik IV*, Version 1.0, *Definitions Plus*, *American Handbook of Business Letters*, *Associated Press Stylebook*, and *KeyNotes Writer's Handbook*.

Professional Write Plus	WordPerfect	WordStar
■ Grammatik IV	□ N/A	□ N/A
□ N/A	□ N/A	■ Microlytics
□ N/A	□ N/A	100,000
■	■	■
■	□	■
Proximity/Merram-Webster	Proprietary	Microlytics
40,000	10,000	2,220
□	■	□
■ Soft-Art	■ Proprietary	■ Microlytics
130,000	115,000	100,000
□	■	■
None	None	Legal, medical, foreign

WRITERS' TOOLS: SUITABILITY TO TASK

Each writers' tool offers a different combination of features. Some packages try to do a little bit of everything; others do only one thing but do it well. These ratings show which package most closely meets your needs.

THE RATINGS

N/A—Not applicable:
The product does not
perform this task.

Suitability to Task

Product Name

Grammar checker	N/A			
Spell-checker	1			
Thesaurus	2			
Dictionary		3		
Style guide			4	
In Short: A brief summary of the product's review.				

1—Poor
2—Fair
3—Good
4—Excellent

THE TASKS



Grammar checker evaluates the program's grammar, punctuation, and style guidance, its ability to make recommendations for changes, and its evaluation of documents for readability. The tutorials and suggestions for emendations offered by some grammar-checking programs give them some usefulness as style guides, but the advice is usually terser and harder to find than in full style guides.



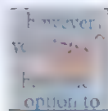
Spell-checker evaluates how well the program scans your document for spelling errors and whether or not it automatically offers properly spelled alternatives. "Automatically" means the program can find and display suitable alternatives without your help; if you are forced to perform this task yourself, the score will be lower.



Thesaurus evaluates both the quantity and the quality of the words generated by the program when you ask for synonyms. Some thesauruses also provide antonyms.



Dictionary evaluates the program's ability to define all senses of a word, as well as provide syllable breaks and plural forms. Some dictionaries also have pronunciation guides and etymologies. A dictionary program can usually verify the proper spelling of a word but cannot perform scans to detect spelling errors. Dictionary programs are not good substitutes for spell-checkers and usually earn a score of 1 in the spell-checker category.



Style guide evaluates the quality of advice the writers' tool gives you for improving your writing. Grammar checkers that offer comprehensive suggestions about your errors can sometimes perform the same tasks as style guides.

many other programs available for writers. The \$29.95 *Letters on Line* (Power Up Software, 800-851-2917) and the \$79.95 *Sales LetterWorks* (Round Lake Publishing, 203-431-9696) are collections of model professional and business letters. *WritePro*, \$119.95 from WritePro Corp. (914-762-1255), will help you plot, populate, polish, and, with luck, publish your novel. If your atlas is too big for your bookshelf, you may find room for the \$199.95 *World Atlas* and *U.S. Atlas* (Software Toolworks, 800-231-3088) on your hard disk. Job applicants will welcome the \$49.95 *ResumeMaker* from Individual Software (800-822-3522); and if you're writing a speech or just looking for laughs, *The Humor Processor*, \$49.95 from Responsive Software (800-669-4611, 415-843-1034), is a good choice.

RESEARCH TOOLS ON CD-ROM

The largest databases for PCs are found on CD-ROM. The best-known of these databases is *Microsoft Bookshelf*, a great idea presented in a seriously flawed implementation. The program will shortly be revised and reissued in *Microsoft Windows* format, and its enhancements will include a faster retrieval engine and a pronunciation version of *The American Heritage Dictionary*. The disk will also contain *Roget's II Thesaurus*, *Hammond's Atlas*, *Concise Columbia Encyclopedia*, *Concise Columbia Dictionary of Quotations*, and the 22,500-item *Bartlett's Familiar Quotations*.

Thousands of articles on computer-related topics are available on the periodically updated *Computer Select* CD-ROM. Other useful disks include *The CIA World Fact Book*, *Compton's Encyclopedia*,

Countries of the World, *Ellis Bible Library*, *Facts on File News Digest*, *GEO-disc US Atlas*, *Government Statistics on CD-ROM*, *Grolier Electronic Encyclopedia*, *Languages of the World*, *The Library of the Future*, *Literature Francaise*, *The McGraw-Hill Science and Technical Reference Set*, *The Oxford English Dictionary*, *Reference Library*, *U.S. History on CD-ROM*, and *The WordCruncher Disc*. *PC Magazine* will be taking a close look at many of these titles in the October 29, 1991, issue. For information about these CD-ROMs, call The Bureau of Electronic Publishing (800-828-4766; 201-808-2700).

While none of the writers' tools evaluated here will automatically improve your writing, they will teach you new words and new ways to say things more clearly and effectively.



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2. Look for a better shell material.

Our composite shell employs a highly flexible material that allows constant contact between the

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3. Look for enhanced magnetic particle performance.



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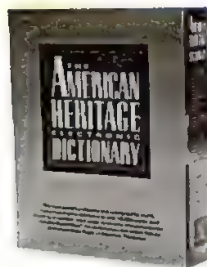


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THE GOLD STANDARD

The American Heritage Electronic Dictionary



Until recently, the amenities found even in small desk dictionaries were not available in electronic form. Now two recently released programs—*The American Heritage*

Electronic Dictionary and *Definitions Plus*—have filled the gap. You won't get a large dictionary with either program—both are based on a 500-page abridgement of the 1,550-page, 150,000-entry *American Heritage Dictionary of the English Language*—but this \$99.95 package from WordStar International is a powerful reference tool.

The American Heritage Electronic Dictionary has been pared down to 116,000 entry words, and its definitions are shorter than those found in printed dictionaries. Even so, its 81.5 score (out of 100) on our performance test for writers' tools with dictionaries indicates that most of the time it will serve you as well as its brawnier cousins.

SYNONYM AND ANAGRAM FINDER

Along with the dictionary you'll get *Roget's II Electronic Thesaurus*, which

SOFTWARE WRITERS' TOOLS

scored in the middle of the pack on our thesaurus tests. The dictionary can also double as a rudimentary spell-checker—rudimentary because it can't scan the text to flag misspelled words.

Installing *The American Heritage Dictionary* is a breeze. The program politely

asks for permission to change AUTO-EXEC.BAT and CONFIG.SYS files. If you say no, you are given instructions for making the necessary modifications on your own. You load the dictionary as a 4K TSR from the DOS prompt, a procedure that took a long 38 seconds on an AT. Then you start running your word processor.



EDITORS' CHOICE

- *The American Heritage Electronic Dictionary*
- *PowerEdit*

If your interest in writers' tools extends no further than strict grammar checking, and you're looking for state-of-the-art software, *PowerEdit* should be your choice. This innovative package is equipped with a huge stock of artificial intelligence-based algorithms that do a great job of parsing and analyzing your sentences. In exchange for \$295, 12MB of hard disk space, and 1MB of extended or expanded memory, *PowerEdit* will give you the best protection against grammar, punctuation, and capitalization mistakes. It also has the most attractive interface, with pull-down menus and pop-up help screens, and unlike its competitors, it lets you back up through a document to view errors you've previously corrected—a small but important detail.

Though a 50 percent success rate for catching errors would be unacceptable for a spell-checker, it's actually an achievement for a grammar checker that has to deal with the idiosyncrasies of the English language. And if any grammar checker has the potential to reach a 70 or 80 percent success rate, it's *PowerEdit*.

Correct Grammar (\$99) is a strong second choice and is, in fact, a better choice for users who don't want to spend \$295 or don't have the hardware to devote to *PowerEdit* but do want spell-checking features. The package landed in second place on the performance tests, and a *Microsoft Windows* version is available.

If all you're looking for is a dictionary, Houghton Mifflin's \$99.95 *American Heritage Electronic Dictionary* is a top performer. The program's 116,000-word lexicon, based on *The American Heritage Dictionary of the English Lan-*

guage, includes etymologies and pronunciation guides, and the package includes *Roget's II Thesaurus* and *Write*, a limited word processor. You can do more than just look up definitions, too. With *SearchText*, the program's text retrieval engine, you can search on "red" and "flower" to generate a list of red flowers. Other routines will help you find anagrams and rhyming words.

Honorable mention goes to WordScience Corp.'s *Definitions Plus*, which also costs \$99.95 and is based on the same reference work. *Definitions Plus*, however, does not have the extra functionality of the Houghton Mifflin software. Performance-wise, it ranks just behind *American Heritage*, but it requires less memory—just 4K as a TSR—and 1MB less hard disk space than *American Heritage*. Balance the trade-offs to make your decision.

None of the bundled packages can qualify for an Editors' Choice, since they are collections of standalone packages rather than completely integrated products. Nevertheless, *The Writer's Pack* (\$149) and *The Complete Writer's Toolkit* (\$129) are bargain hunters' dreams. Both programs include grammar checkers, thesauruses, dictionaries, and assorted utilities for prices far less than the components would cost if purchased separately.

Spell-checkers are now included with most major word processors. Chances are that it will be easier and faster for you to use the spell-checker that's integrated with your word processor than to use an add-on, but if you use a grammar checker that includes a full spell-checker, you can take care of both concerns in one pass.

Suitability to Task

The American Heritage Electronic Dictionary

Grammar checker	N/A
Spell-checker	1
Thesaurus	3
Dictionary	4
Style guide	N/A

In Short: This is the first on-line writers' tool that provides a full complement of dictionary functions, including etymologies and pronunciation guides. *The American Heritage Electronic Dictionary* comes integrated with *Roget's II Electronic Thesaurus* and some interesting utilities, such as an anagram generator and a routine for doing Boolean searches through the dictionary.

How does Sony fit
a set of encyclopedias,
a world atlas, twelve
international dictionaries,
a children's book, a slew
of reference books,
and one or two hippos
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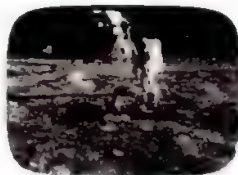
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Sony Laser Library™ CD-ROM system. It's a CD player for your computer. And it's available for only a fraction of the cost of many PC's. Connect it to your IBM XT/AT® or compatible computer and get libraries of information presented in a way you've never seen or heard before. With this multimedia technology, you can now experience remarkable

comparable to reading every word in a stack of typewritten pages three stories high. The potential of this technology is virtually unlimited.

Bringing information down to size.

Now, here's the amazing part. The Laser Library CD-ROM system comes complete with *Compton's Family Encyclopedia*™ CD.



It contains 26 volumes with 32,000 entries, adding up to over nine million words. All accessible in the blink of an eye. Plus, you can view color photographs and charts. And it even has audio clips of famous speeches and music. *Suggested retail value—\$695**

Speak your mind.

But the encyclopedia software is only one of six CDs that comes with the Laser Library CD-ROM system at no extra cost beyond the CD-ROM drive itself. Also included is *Languages of the World*. This program gives you the equivalent of 132 dictionaries. It lets you translate between Chinese, Danish, Dutch, English, Finnish, French, German, Italian, Japanese, Norwegian, Spanish and Swedish. *Suggested retail value—\$950**

The world is in your hands.

To learn more about

the countries where all of these and other languages are spoken, just insert *The Software Toolworks™ World Atlas* CD. There are over 240 fully detailed maps and hundreds of pages of data on 70 different topics. Find important information about any country or city in the world in no time at all. You probably never thought geography could be so easy.

*Suggested retail value—\$79.95**

It makes learning child's play.

For those of you with little students at home, there's a wonderful learning tool for them, too: *Mixed-up Mother Goose™*, an interactive game that helps stimulate your



child's imagination, with music and realistic sounds that bring a whole new approach to story-telling. *Suggested retail value—\$59.95**

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Just the beginning.

This collection of soft-

ware obviously makes the Laser Library CD-ROM system an irresistible offer. Its total suggested retail value is over \$2,000*, several times the cost of the CD-ROM drive itself. But the value of its technology goes far beyond its price. Included with this package is a catalog listing dozens of additional titles that you can order directly from Sony. And more new titles for business, education and entertainment are being

made available all the time.

Check our references.

Finally, to make reference materials readily available for the whole family, the Laser Library CD-ROM system comes complete with *Micro-soft® Bookshelf™ 1991 Edition*.

This invaluable tool includes The American Heritage Dictionary, Roget's II Thesaurus, the World Almanac and Book of Facts, The Concise Columbia Encyclopedia, The Concise Columbia Dictionary of

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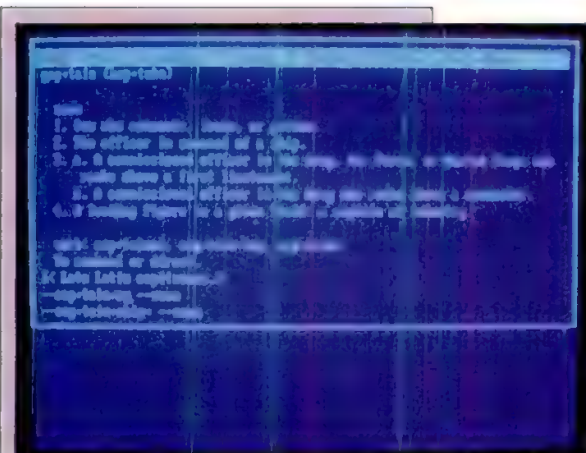
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The American Heritage Electronic Dictionary gives pronunciation information, parts of speech, different meanings, etymology, and variant forms of the word being defined. Synonyms are available from an integrated thesaurus program.

To get definitions, you position the cursor and hit a hotkey; or you can type in a word. If you're not sure about a word's spelling you can use wildcards. Entering wildcards for all but the last syllable of a word will let you find rhyming words. Along with definitions, the program provides parts of speech, variants in meaning, etymologies, syllable breaks, and pronunciation guides.

In addition, *The American Heritage Dictionary* offers SearchText, a retrieval engine that lets you perform Boolean searches through all of the dictionary's definitions. Thus, if you enter the string "mythology AND Greek OR Greece" you get an alphabetical list of relevant words ("Adonis, Agamemnon, Amazon, ambrosia, etc."). Still another routine generates anagrams, which should make this a can't-live-without-it item for Scrabble lovers.

CHECK FOR COMPATIBILITY

The biggest limitation of *The American Heritage Dictionary* is its disappointing speed on slower computers. On an AT, it needs 6 or 7 seconds to look up a word, and exiting takes about the same time. Another drawback is the program's limited compatibility. At the moment, it's guaranteed to work only with recent releases of DisplayWrite, MultiMate, Microsoft Word, Microsoft Works, WordPerfect, and WordStar.

With other word processors it usually managed to display dictionary and thesaurus screens, but it wasn't always successful at reading a word processor's files. Occasionally, the package's response to an unfamiliar program was to crash. This may be why *The American Heritage Dictionary* is bundled with *Writer*, a small compatible word processor. *Writer* can convert its own files into ASCII format, but it would be much more useful if it could convert existing ASCII files, such as those exported from your word processor, into its format.

Minor complaints aside, this is an impressive program. Once you discover how easy it is to look up words, you'll probably do it more frequently and add precision to your writing in the process. If you were pleasantly surprised when you first tried a spell-checker, prepare to relive the experience with *The American Heritage Electronic Dictionary*.

EDITORS' CHOICE

The American Heritage Electronic Dictionary, Version 1.01

WordStar International Inc., Writing Tools Division, 201 Alameda del Prado, Novato, CA 94949; 415-382-8000.

List Price: \$99.95.

Requires: 43K RAM, 3MB available disk space, DOS 2.0 or later.

CIRCLE 397 ON READER SERVICE CARD

The Complete Writer's Toolkit



The Complete Writer's Toolkit, Version 1.1, is a Swiss Army knife of handy utilities designed to help you write better. Priced at \$129, this software from Systems Compatibility

Corp. bundles six modules into a single package: Houghton Mifflin's *CorrectText* grammar checker, *The American Heritage Electronic Dictionary*, *Rogel's II Electronic Thesaurus*, *The Concise Columbia Dictionary of Quotations*, *The*

Houghton Mifflin Abbreviation Program, and *The Written Word III*, a style manual.

Except for variations in interface design, the first three programs are the same as their standalone versions. For information about the dictionary and thesaurus, see the review of *The American Heritage Dictionary*. For an evaluation of the grammar checker, see the review of *Correct Grammar* (which is also based on the *CorrectText* engine).

The Complete Writer's Toolkit is a hefty program that comes on 13 floppy disks and takes up 5.7MB of hard disk space with all the modules installed. All but the grammar checker are integrated and can be started from a menu that pops up inside of the supported word processors or at the DOS prompt. (The grammar checker can only be loaded from the DOS prompt.) The program needs 512K to run, and it cannot take advantage of high memory.

There's an attractive feature in *CorrectText* that's not available in *Correct Grammar*, its standalone counterpart. The directory that lists files for a grammar check has a split screen that allows you to tab to a filename and peek at its contents. The thesaurus has a similar feature, again not available in the Houghton Mifflin version of *Rogel's II Thesaurus*: As you look through various definitions of an entry word, a series of synonyms for each definition is displayed in an adjacent window.

The Complete Writer's Toolkit kernel program can take advantage of high memory, if you have any. If not, the

Suitability to Task

The Complete Writer's Toolkit

Grammar checker	3
Spell-checker	3
Thesaurus	2
Dictionary	4
Style guide	3

In Short: This is a large, bundled package—containing a grammar checker, dictionary, thesaurus, quotation dictionary, abbreviation finder, and style manual; and it is attractively priced.

WRITERS' TOOLS WITH GRAMMAR CHECKERS: SUMMARY OF FEATURES

Products listed in ascending price order

	Editor	Correct Grammar	Grammatik IV	RightWriter	Electric Webster	The Writer's Pack (Grammatik IV, Version 1.0)	PowerEdit
List Price	\$45.00	\$99.00	\$99.00	\$99.00	\$129.95	\$149.00	\$295.00
Analyzes document sentence by sentence includes full spell-checker*	┘	■	■	┘	■	■	■
Number of words or phrases contained in spell-checker	1,500 phrases	135,000 words	72,000 words	N/A	50,000 words	50,000 words	10,000 words
Telephone technical support	┘	■	■	■	■	■	■

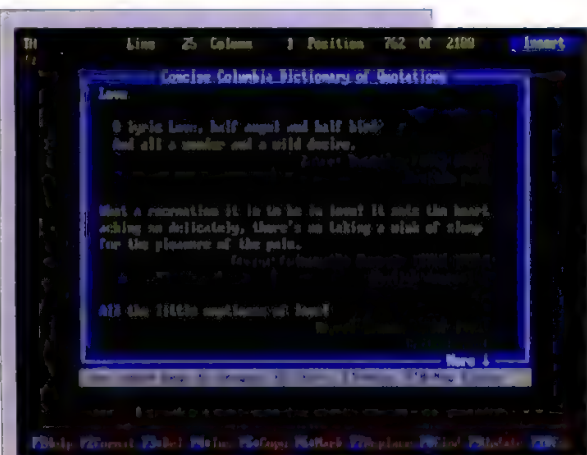
■ —Editors' Choice

■ —Yes

┘ —No

N/A—Not applicable: The product does not have this feature

*Some programs have conventional spell checkers, others, like *PowerEdit* and *Editor*, check only for commonly misspelled words or phrases.



The Concise Columbia Dictionary of Quotations, one of the programs included in *The Complete Writer's Toolkit*, will display quotations by author or by topic. This is part of the display for "love."

program can swap to floppy disk, although this slows down its operation. In Version 1.1, you can launch all but the grammar checker from a TSR, which requires only 10.6K RAM. This means you can get *The American Heritage Dictionary* (the one with etymologies, pronunciation guides, and an anagram generator) at a memory cost that is actually lower than that of the standalone version.

ALL-IN-ONE WORDSMITH

The Concise Columbia Dictionary of Quotations module contains 6,070 entries, not as many as the 22,500 quotations in

Bartlett's *Familiar Quotations* (available on the *Microsoft Bookshelf* CD-ROM), but how much hard disk space do you really want to give up to a quotation program? The *Columbia Dictionary* lists items under topic headings such as "Love" or "Law." You can enter a word from your text to search for a corresponding topic heading, or seek quotation listings by author.

The Abbreviation Program in the package is a supplement to the dictionary and is basically what you would expect. If you type in "etc." you'll learn that it's short for "et cetera" and that it means "and so forth." *Written Word III* is a style manual that discusses grammar, punctuation, and proofreading, and includes tutorials on using a library and writing reports, letters, and résumés. It also contains a usage glossary—a series of alphabetically arranged entries on the many problems encountered in writing.

Written Word III's search routine could be improved: There's no easy way to scan through the entire manual, and you can't conduct whole-word searches. When we searched for "able"—a topic listed in the program's usage glossary—the search turned up "syllable" and "currency table."

LONG ON FEATURES, SHORT ON EASE

The Complete Writer's Toolkit is a remarkably feature-rich collection, but many

of its command sequences are clunky. For example, if you want a definition for the word "mark," it takes one keystroke to get to the main menu, another to reach the dictionary, another to choose which of three connotations of "mark" you want, and yet another to display the definitions list. For words with fewer meanings, one of these steps is eliminated, and you can bypass the menu by memorizing a hotkey combination for each module. Even so, this and other operations could be more efficient.

THUMB-TWIDDLING

Another problem you may encounter is the program's unimpressive timing on AT-class machines, on which it takes at least 25 seconds to execute a simple operation. On a 386-based machine, however, everything moves at a good clip. You'll wait no more than a second or two for any command to be executed.

If you have a 386- or 486-based PC and a fast hard disk, you'll like *The Complete Writer's Toolkit*. But if you own an XT or AT, see what 25 seconds of thumb-twiddling feels like before you decide whether or not you want to give this program a try.

The Complete Writer's Toolkit, Version 1.1

Systems Compatibility Corp., 401 N. Wabash, #600, Chicago, IL 60611; 312-329-0700.

List Price: \$129.

Requires: 512K RAM (10K for memory-resident tools), 5.7MB available disk space, DOS 2.0 or later.

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SOFTWARE WRITERS' TOOLS

WRITERS' TOOLS WITH DICTIONARIES: SUMMARY OF FEATURES

Products listed in ascending price order

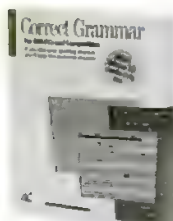
	Franklin Language Master	The American Heritage Electronic Dictionary	Definitions Plus	The Complete Writer's Toolkit (The American Heritage Electronic Dictionary)	The Writer's Pack (Definitions Plus)
List Price	\$79.95	\$99.95	\$99.95	\$129.00	\$149.00
Number of words claimed in lexicon	80,000	116,000	115,000	116,000	115,000
Runs as a TSR	■	■	■	■	■
Has look-up window	■	■	■	■	■
Has help window	■	■	■	■	■
User can redefine hotkeys	■	■	■	■	■
Provides different definitions of a word	■	■	■	■	■
Provides etymology	■	■	■	■	■
Provides antonyms	■	■	■	■	■
Gives pronunciations	■	■	■	■	■
Shows syllable breaks	■	■	■	■	■
Supports definition chaining	■	■	■	■	■
Tracks entry words during chaining	■	■	■	■	■
Recognizes hyphens linking whole words	■	■	■	■	■
Recognizes unhyphenated compound words	■	■	■	■	■
Includes integrated thesaurus	■	■	■	■	■
Works interactively with a thesaurus	■	■	■	■	■
Can window back to document	■	■	■	■	■
Can print definition display	■	■	■	■	■
Generates word list for misspelled entry words	■	■	■	■	■
Includes anagram generator	■	■	■	■	■
Includes quick-reference card	■	■	■	■	■
Telephone technical support	■	■	■	■	■

■—Editors' Choice

■—Yes

□—No

Correct Grammar



Correct Grammar has been on the scene long enough to have acquired a genealogy. It came into the world as Lifetree Software's release of Houghton Mifflin's *CorrecText*

program. Priced at \$99, *Correct Grammar*, Version 3.0, is now being distributed by WordStar International, which recently bought Lifetree. *Correct Grammar for Windows*, the first program that can grammar check any *Microsoft Windows* application, was recently introduced, although too late to be tested here.

Correct Grammar requires 440K RAM and takes up about 1MB of your hard disk. The program is simple to install, and while it comes with a tutorial, the menu-based structure is easy enough to pick up on your

own. Menus are also used for changing grammar rules, defaults, and writing styles with rules specific to business, technical, or informal composition.

STYLE COACHING

A welcome option is the program's "Quiet" command, which lets you disable a particular rule for a single session or permanently. Another plus is the program's context-sensitive tutorial command. If you don't understand a correction, you can choose this option to get more information. With this feature, *Correct Grammar* also functions as a style manual.

When you start the program, you are first asked about the word-processing format of your document. *Correct Grammar* then begins an interactive scan of your text. If you prefer not to use the interactive mode, the program can mark up a copy of the original document. When



Correct Grammar's commands are invoked by the number keys or by the initial letters of command words. Corrections appear in a small box, which lets you see a good portion of your document.

you select this mode, though, you'll lose some of the options for corrections and tutorials.



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CIRCLE 272 ON READER SERVICE CARD

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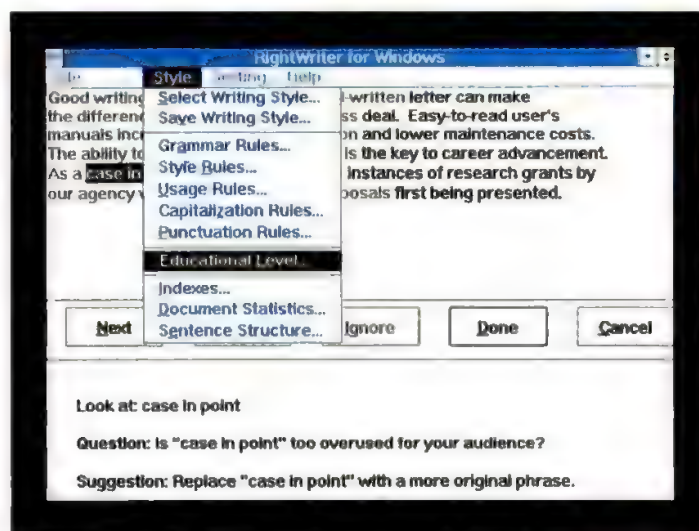
mode proofreads your documents just like a spell checker, offering real-time suggestions to improve your writing. Now you can add immediate impact to your writing with the click of a mouse button!

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Whatever the version, whatever the platform, the industry recognizes RightWriter as the best grammar and style checker on the market. Recent tributes to RightWriter's effectiveness include:



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Retail
Price

\$99⁹⁵



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WRITERS' TOOLS WITH THESAURUSES: SUMMARY OF FEATURES

Products listed in ascending price order

	Easy Working Thesaurus	Whoops!	Word Finder	Franklin Language Master	The American Heritage Electronic Dictionary	The Complete Writer's Toolkit (The American Heritage Electronic Dictionary)
List price	\$14.95	\$49.95	\$59.95	\$79.95	\$99.95	\$129.00
Thesaurus comes in two sizes	☐	☒	☒	☐	☐	☐
Total number of words/references contained in thesaurus	60,000	90,000	660,000	1,400,000	500,000	500,000
Number of root words contained in thesaurus	60,000	17,500	45,000	40,000	42,000	42,000
Has look-up window	☐	☒	☒	☒	☒	☒
Has mobile screen display	☐	☐	☒	☐	☐	☐
Removable from RAM without rebooting	☐	☒	☒	☒	☒	☒
Clusters synonyms by parts of speech	☐	☐	☒	☒	☒	☒
Clusters synonyms by meaning	☐	☐	☒	☒	☒	☒
Supports synonym chaining	☒	☒	☒	☒	☒	☒
Prints synonym display	☒	☒	☒	☒	☐	☐
Tracks or restores old synonym display	☐	☒	☒	☐	☐	☐
Recognizes hyphens linking whole words	☐	☐	☒	☒	☐	☐
Capitalizes replacement synonym when appropriate	☒	☐	☒	☒	☐	☐
Provides antonyms	☐	☒	☐	☒	☐	☐
Permits windowing back to document	☐	☐	☐	☒	☐	☐
Recognizes entry words in plural form	☐	☐	☒	☒	☒	☒
Replaces plurals with plural synonyms	☐	☐	☐	☒	☒	☒
Makes a/an article changes	☐	☐	☒	☒	☐	☐
Includes quick-reference card	☐	☐	☒	☐	☐	☐
Telephone technical support	☒	☒	☒	☒	☒	☒

—Editors' Choice

☒—Yes

☐—No

DETECT AND CORRECT AT ONCE

Like *Grammatik*, *Correct Grammar* has the ability to both detect and correct spelling errors. You'll find it convenient to perform grammar and spell-checks in a single pass. On our spelling performance test, *Correct Grammar*'s 135,000-word lexicon scored a very respectable 87 out of 100. All of the programs except *Electric Webster* scored about the same on this spelling correction test, which included a wide range of errors in common and less-common words, proper nouns, foreign words, abbreviations, scientific terms, and hyphenated words.

Even so, the program is slower and harder to use than most spell-checkers. It doesn't always display alternatives when it finds a misspelled word. Usually, you have to enter a command and wait while the alternative words are retrieved. Once you have finished scanning, the program

Suitability to Task

Correct Grammar

Grammar checker	☐	☐	☒	3
Spell-checker	☐	☐	☒	3
Thesaurus	☒	☒	☒	N/A
Dictionary	☒	☒	☒	N/A
Style guide	☐	☐	☒	2

In Short: If you don't have the hardware platform necessary to run *PowerEdit*, *Correct Grammar* makes a good second choice. Its performance scores are somewhat higher than those of its nearest rival, *Grammatik IV*—although *Grammatik* does have a superior interface and runs faster. *Correct Grammar* for Windows was recently released.

rates your document according to various readability tests.

Correct Grammar's sluggish pace can be a hindrance. Going through the menu choices can be slow, as can retrieving information you need for entering corrections. And there is no simple way of rejecting *Correct Grammar*'s recommendations and going directly to another problem. Instead, the program returns to the previous sentence to let you recheck a passage in case your correction introduced an error. The program should let you bypass this feature when you don't need to use it.

Another irritating problem is that *Correct Grammar* sometimes skips over passages containing errors without scanning them. And once it has moved on, you can't go back to check a passage that might have an error.

As the performance tests indicate,

SOFTWARE WRITERS' TOOLS

Correct Grammar is the second-best performer in the grammar checking group, with most results in the 30 to 40 percent success-rate range. While this means that many of your grammatical errors may go undetected, such scores aren't at all bad, given the difficulty of designing efficient grammar checkers. Unless you own a fast 386-based machine with the memory needed to run *PowerEdit*, *Correct Grammar* is your best choice.

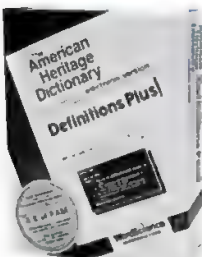
Correct Grammar, Version 3.0
WordStar International, Writing Tools Division, 1 Harbor Dr., #111, Sausalito, CA 94965; 800-523-3520, 415-332-8692.

List Price: \$99.

Requires: 512K RAM, 1MB available disk space, DOS 2.0 or later.

CIRCLE 399 ON READER SERVICE CARD

Definitions Plus



Both WordScience Corp.'s *Definitions Plus* and *The American Heritage Electronic Dictionary* are \$99.95 reference works based on an abridged edition of the familiar 1,500-page *American Heritage Dictionary*. *Definitions Plus* lacks the geographical

and biographical data in the original, as well as most of the technical terms, but the remaining material still makes for a first-rate, memory-efficient reference tool.

Definitions Plus received a score of 79

Definitions Plus will run inside any thesaurus or writers' tool integrated with a compatible word processor such as WordPerfect or Microsoft Word.

out of 100 on our dictionary performance test, slightly lower than *The American Heritage Electronic Dictionary*'s score of 81.5. These similar scores aren't surprising, given that *Definitions Plus* claims just slightly fewer words in its lexicon: 115,000 versus 116,000.

EXTRA MEMORY SUPPORT

The programs differ in extras: *Definitions Plus* lacks the etymologies, pronunciation guides, an anagram generator, Boolean routines for finding conceptually related words, and an integrated thesaurus that comes with *The American Heritage Dictionary*. On the other hand, while *The American Heritage Dictionary* needs a minimum of 43K RAM to operate as a TSR, the abstemious *Definitions Plus* can manage with only 4K.

This feat is accomplished by taking advantage of extended or expanded memory. If you don't have any high memory, the program will swap to disk, although this can slow down look-up times considerably.

The lack of a thesaurus in *Definitions Plus* may not be a handicap. *Roget's II*

Electronic Thesaurus, which is bundled with *The American Heritage Dictionary*, is only a fair reference. Moreover, *Definitions Plus* will run inside any thesaurus or other writers' tool that is integrated with a compatible word processing program. For example, you can easily look up a word that's displayed in *WordPerfect*'s thesaurus or *Microsoft Word*'s spell-checker.

Other advantages include an installation routine that runs like a gem, an attractive interface, and an intelligent program design. You can change word processors, colors, and hotkey definitions from inside the main program. Like *American Heritage*, the program lets you define words at the DOS prompt. And when the dictionary doesn't recognize a term, it gives you a list of alternatives; a handy feature when you're not sure about the spelling of a word.

MEETING THE COMPOUND CHALLENGE

Definitions Plus has an effective way of dealing with compound words—a challenge that many other writers' tools do not yet address. After you have placed the cursor at the first part of the word (for example, "home" in "home run"), you can mark the rest of the term and submit it as an entry word.

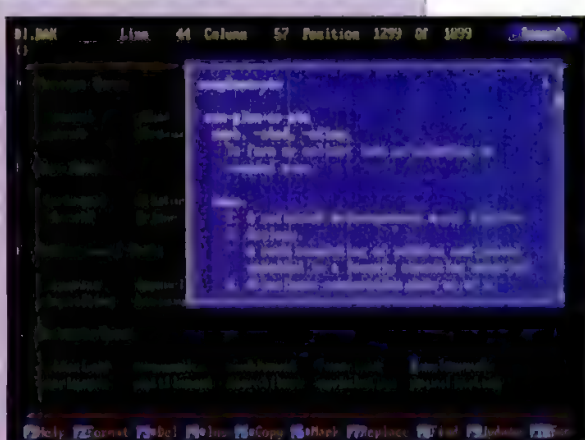
One note of caution: The kernel program can be somewhat finicky. The manual warns that trying to run other TSRs while the program is loaded can crash your system. You'll have to remember to unload the program before starting another TSR.

Suitability to Task

Definitions Plus

Grammar checker	N/A
Spell-checker	1
Thesaurus	N/A
Dictionary	4
Style guide	N/A

In Short: *Definitions Plus* lacks some of the features found in *The American Heritage Electronic Dictionary*, such as etymologies, pronunciation guides, anagram generation, and an integrated thesaurus. But it is still an excellent reference tool and can run as a tiny 4K TSR.



Definitions Plus, based on *The American Heritage Dictionary*, pops up over your word processor to give syllable breaks, verbal forms, and definitions clustered under a word's parts of speech.

FINDING THE PERFECT QUOTATION: Can Quotemaster Plus Beat Bartlett's?

by Emerson A. Torgan

Bookstores offer many different compilations of quotations on various themes, and old standbys like Bartlett's *Familiar Quotations* have been gathering memorable utterances since 1855. On the software shelf you can find *Wisdom of the Ages*, a \$79 package from MCR Agency (800-767-6797) that delivers 6,561 "carefully selected thoughts" from world history, and *Microsoft Bookshelf* (\$295) offers access to all 22,500 quotations that can be found in Bartlett's on CD-ROM. Microsoft plans to release *Microsoft Bookshelf for Windows* later this year for \$195, and it will include an additional 6,000 quotations from *The Concise Columbia Dictionary of Quotations*.

Finding that perfect quotation to spice up a speech or a presentation is the task that another software package, *Quotemaster Plus*, aims to simplify. This \$89 quotation database from PennComp Software Development gives access to 3,000 quotations in its Primary Literary quotebase, and additional collections—Humorous, Success, Contemporary, Motivational—sell for \$25 each. You can get all five, containing a total of over 5,000 quotations, for \$169.

FINDING THE GEM

The package is relatively easy to use, which is a blessing when you consider that 33 pages of incomplete documentation is all the help that you get. You'll have to sacrifice about 2.9MB of disk space to the package and may be frustrated by the clunky interface. The program has no way to back up to a previous screen—a particularly annoying problem when you're weeding through five screens of H.L. Mencken's Baltimore wit.

There are three ways to locate a quotation: by subject, by author, and by era. Entering "MAN" in the subject field yields over 100 quotations by various authors, and entering a specific author in the same search cuts the list substantially. You can also search the

entire quotebase for a string, such as "bo," and get every quotation containing those letters—aboard, Boer, bowling, and so on. This function can be quite helpful if you remember a quotation about "quiet desperation" but don't recall that it was Thoreau who wrote it.

Searching by era is a bit unrealistic. Chances are that if you already know that Emerson was born in 1803, you also know he said, "The dead sleep in their moonless night; my business is with the living."

Once you have located the proper quotation, you can either print it or send it to a new text file. You can't merge it into an existing word processing document, however, because when you call up the file, all you will find is the quotation.

SPEED VERSUS DEPTH

Quotemaster Plus is quick but somewhat shallow. The quotations appear to have been chosen for their brevity rather than for their power. Even so, Roosevelt's "The only thing we have to fear is fear itself," Sherman's "War is hell," and Machiavelli's "Let the ends justify the means," are all overlooked. It can take hours of page-turning to find the right quotation in Bartlett's, but with nearly five times as many entries, chances are greater that you'll be rewarded with the perfect words.

If you need to cough up the wit and wisdom of the centuries on short notice, *Quotemaster Plus* might just save the day, but as Samuel Johnson once said, "One of the most pernicious effects of haste is obscurity."

Quotemaster Plus, Version 4.0

PennComp Software Development, 4660 Beechnut St., #214, Houston, TX 77096; 800-326-6145, 713-669-0965. **List Price:** \$89; four additional quotebases with 500 quotes each, \$25 each; complete set with 5,000 quotations, \$169. **Requires:** 512K RAM, DOS 2.1 or later. *Microsoft Windows* version available.

CIRCLE 396 ON READER SERVICE CARD

If you're torn between *Definitions Plus* and *The American Heritage Electronic Dictionary*, consider a bit of traveler's wisdom: the more you pack, the more you lug to the airport. Choosing the extra features in *American Heritage* means you'll need to surrender some RAM and an extra megabyte on your hard disk. If that's a burden, you can lighten the load with *Definitions Plus*. Regardless of the program you select, you'll get a powerful dictionary that's only a keystroke away.

Definitions Plus, Version 2.02

WordScience Corp., 1415 Oakland Blvd., #220, Walnut Creek, CA 94596; 415-939-1190.

List Price: \$99.95.

Requires: 256K RAM, 2.3MB available disk space, DOS 2.0 or later.

CIRCLE 400 ON READER SERVICE CARD

Easy Working Thesaurus



Spinnaker Software Corp., a leading developer of software for home and small business users, takes the task of synonym selection lightly. While some packages plod along under the

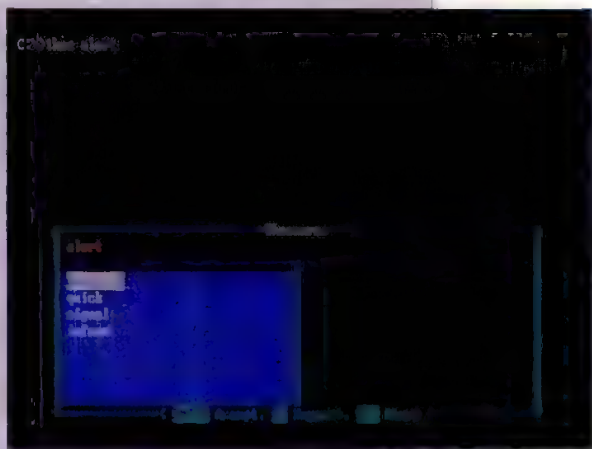
weight of 400K lexicons and work only with the top-rated word processors, the \$14.95 *Easy Working Thesaurus* offers a slim 97K lexicon that is certified compat-

Suitability to Task *Easy Working Thesaurus*

Grammar checker	N/A
Spell-checker	N/A
Thesaurus	1
Dictionary	N/A
Style guide	N/A

In Short: A small, inexpensive thesaurus that offers few special features and cannot always be relied upon for accurate synonyms.

SOFTWARE WRITERS' TOOLS



You can have *Easy Working Thesaurus* pop up inside one of the compatible word processors or (as shown here) you can start it from the DOS prompt. The synonyms are displayed in the left-hand box; hitting the F3 key will chain synonyms. In this case, the program will display synonyms for "watchful."

ible only with low-end word processors like *Bank Street Writer*, *Better Working Word Processor*, *Easy Working Writer*, *Eight-in-One*, *PFS:Professional Write*, *PC-Write*, and *Value Write*.

NIMBLE BUT LIMITED

Even on a 286-based machine, *Easy Working Thesaurus* is fast. To keep it nimble, Spinnaker has stripped it of extravagances. Look elsewhere if you want routines for flagging hyphenated terms, recognizing plurals, clustering synonyms by parts of speech, or grouping words by meaning. It also lacks a command for exiting without rebooting, and the manual comes only in electronic form, though you can print it out.

Easy Working Thesaurus earned only 24 points on the thesaurus performance test (it came in last). The program suggested some innovative, but rather unreliable, synonyms. For instance, "turn" came up as a substitute for "swing," and "fine" was recommended as a synonym for "light." It also equated "hook" and "lock," "wild" and "lush," "satisfy" and "induce," "hunger" and "starvation," "expression" and "grimace." So swing up the fines and unhook the door: Spinnaker's lush lexicographers want to induce your starvation for new grimaces.

If you want a lightweight thesaurus

designed to run on one of the lower-tier word processors, and want it at a rock-bottom price, then this may be your only choice.

Easy Working Thesaurus, Version 1.0

Spinnaker Software Corp.,
201 Broadway,
Cambridge, MA 02139;
617-494-1200.

List Price: \$14.95.

Requires: 256K RAM,
DOS 2.0 or later.

CIRCLE 401 ON READER SERVICE CARD

Editor



Editor, Version 4.0, is a \$45 grammar checker published by the Modern Language Association, an organization of college-level language teachers. Its unimpressive scores on the grammar performance tests, however, are lower than those of *PowerEdit*, *Correct Grammar*, *Grammatik IV*, and *Electric Webster*.

Editor was better at finding stylistic and grammatical mistakes than at flagging punctuation errors. The program detected errors in 27 percent of the sentences with grammatical problems, and in 12 percent of the incorrectly punctuated sentences. It was also good at flagging archaic expressions, colloquialisms, doubled words, clichés, and superfluous punctuation marks.

MLA suggests that, when used in tandem, *Editor* and *Correct Grammar* will complement one another. We found that, in fact, they missed and flagged many of the same errors. Since *Correct Grammar* is the more powerful program, it will pick up mistakes that *Editor* can't detect.

Editor comes with useful routines for listing redundant words in your text and for producing a word-frequency list for

Suitability to Task

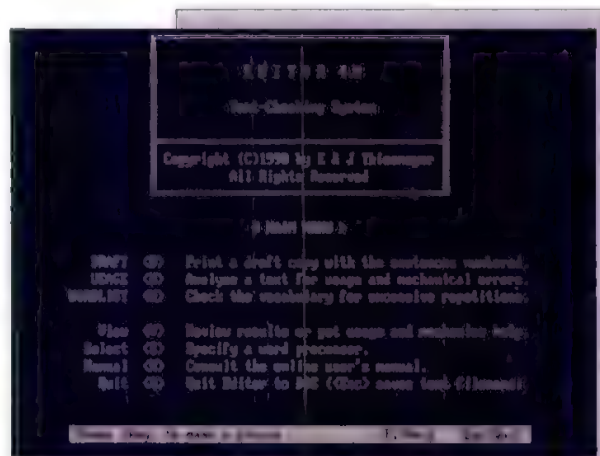
Editor

Grammar checker	2
Spell-checker	N/A
Thesaurus	N/A
Dictionary	N/A
Style guide	1

In Short: *Editor* is less powerful than many of the better-known grammar checkers. Its lack of integrated scan functions makes for awkward grammar checking.

your entire document. There's also a convenient electronic version of the printed manual that you can display and reference when you have the program up and running.

To start grammar checking, you go into Draft mode to access a routine for numbering the sentences in your document and then print its output file. Next you go to Usage mode, where four program modules scan your document seeking different types of errors. On an AT-class machine, this four-part process takes



Editor's main menu lets you create a copy of your document with the sentences numbered. After printing out a copy of this file, you give the command for the program to analyze the text; then you compare the numbered corrections to the numbered sentences in the printout.

about 2 minutes for a 20K file.

Because *Editor* doesn't work interactively, you then have to display the numbered corrections on-screen, match them with corresponding sentences in the printout, and enter the revisions by hand. The correction subroutines aren't integrated, so you'll have to go through your document four times in order to add all of the suggested editing corrections.

Finally, you'll need to transfer the handwritten corrections to the electronic version of your document. Sound tedious? You bet. Even *RightWriter*, which does not win awards for ease of use, won't make you work this hard. *Editor* is one of those supposedly time-saving programs that isn't.

Editor, Version 4.0

Modern Language Association, 10 Astor Place, New York, NY 10003; 800-955-8275.

List Price: \$45.

Requires: 256K RAM, DOS 2.0 or later.

CIRCLE 402 ON READER SERVICE CARD

Electric Webster



Cornucopia Software's *Electric Webster*, \$129.95, is a small, 285 K grammar checker that's fully compatible with only two word processors, *WordStar* and *Open Access*. The program be-

gins by scanning your document off-screen, a procedure that takes about 20 seconds on an AT-class machine for a 20K ASCII file. When the scan is completed, the program displays a list of words that the 50,000-word spell-checker has flagged. If you wish, you can print the list.

During the next stage, the misspelled words are displayed again, one at a time, and you're given a chance to correct them. Because you can't see the misspelled words in context, correcting them can be difficult. You can save each word to another segment of the program in which it will be displayed in context, but doing this for every word is a bother.

Instead of offering correctly spelled alternatives for misspelled terms, *Electric Webster* displays a section of its lexicon



PERFORMANCE TESTS: WRITERS' TOOLS WITH GRAMMAR CHECKERS

None of the grammar checkers we tested were 100 percent effective in catching grammar, style, or punctuation errors. In fact, the best products reached accuracy levels below 50 percent.

HOW WE TESTED

Our test uses examples of errors that typically occur in business and professional writing. The errors in the sample sentences are based on those often described in composition handbooks and style manuals directed toward people in the business and professional communities. Vendors sometimes publish test results based on sample documents, but such tests are unreliable when they reflect the idiosyncrasies of a single author's style.

Our test contains 50 common errors in punctuation and capitalization, and 75 common errors in grammar and style. Because the English language has so many odd constructions, each error appears in two different ways (in two different sentences) in the test. This offsets the possibility that a single example may be unusually easy or difficult for a particular program to detect. As it turned out, some grammar checkers were capable of detecting only one of the two examples of a problem.

Because the test is too extensive to print in its entirety, here are sets of sample sentences.

Punctuation, Missing Apostrophe:

Its a fair deal.

The mans coats were in the closet.

Punctuation Missing, Parenthetical Statement:

He enjoys or used to enjoy trout fishing.

Swimming on the other hand was not a favorite sport.

Grammar, Simple Error in Tense:

She has cross the street.

Jack will rode to school.

Grammar, Like/As Confusion:

She is pretty like a picture.

Do like I say, not like I do.

Grammar, Redundancy:

His most obvious technique is a sleight-of-hand technique.

Another method Bill uses is to use persuasion.

HOW WE AWARDED POINTS

A grammar checker will respond to errors in one or more of the following ways:

- Miss: The program ignores an error.
- Hit: The program flags an error.
- Advice: The program gives suggestions for correcting an error.
- False flag: The program detects nonexistent errors or recommends corrections that introduce new errors.

To measure performance, points were awarded for successful error catching.

Hits:

- 0—Misses error.
- 1—Detects error.

Advice:

- 0—Fails to detect error.
- 1—Flags error but gives misleading advice for correction.
- 2—Flags error but gives little useful advice, or flags only one of multiple errors in the sample sentence.
- 3—Flags error; advice is helpful but incomplete.
- 4—Flags error; gives adequate advice for corrections or correct alternative to error.

False flags:

- 0—No false flags.
- 1—One or more false flags.

WHAT THE NUMBERS MEAN

Most grammar checkers can be tuned to respond to a greater or smaller number of errors. As they become more sensitive to errors, the rate of false flagging also goes up. The programs tested were tuned so that they produced hits more often than false flags. The hits-to-false-flags ratio is the number of hits divided by false flags rounded to the nearest whole number. The higher the hits-to-false-flags ratio, the better a program is at catching only real errors.

While *PowerEdit* had the best overall success at catching errors and gave the best advice, both *Correct Grammar* and *Grammatik IV*, Version 2.0, were better at not raising false alarms. Note that the older *Grammatik IV*, Version 1.0, included in *The Writer's Pack* was not as successful as the newer standalone version.

PUNCTUATION

The **Punctuation** test checks for common errors in punctuation and capitalization in 100 test sentences. The test is based on errors frequently listed in composition handbooks. One point per sentence is awarded for catching the error, up to 4 points are awarded for the quality of advice the program gives, and 1 negative point is given when the program flags a false error.

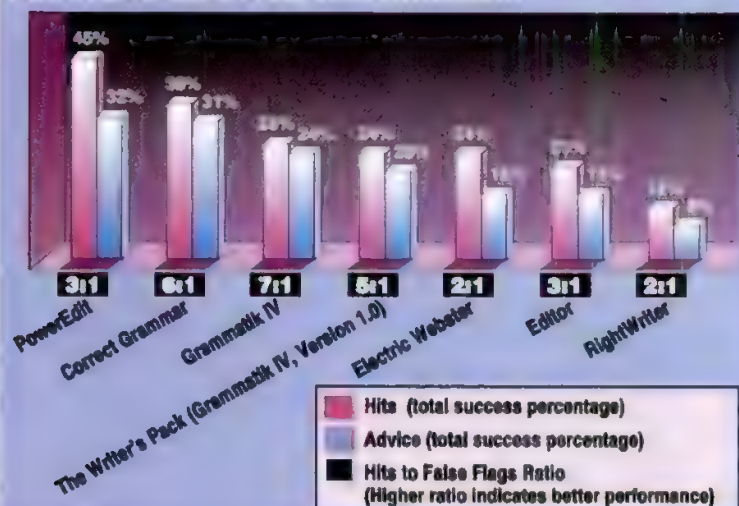
	Hits (out of a possible 100)	Advice (out of a possible 400)	False Flags (worst score = -100)
PowerEdit	36	93	-23
Correct Grammar	24	75	-7
Grammatik IV	21	76	-4
The Writer's Pack (Grammatik IV, Version 1.0)	16	54	-4
Electric Webster	15	34	-6
Editor	12	34	-5
RightWriter	9	16	-3

STYLE AND GRAMMAR

The **Style and Grammar** test checks for common errors in style and grammar in 150 test sentences. One point per sentence is awarded for catching the error, up to 4 points are awarded for the quality of advice the program gives, and 1 negative point is given if the program flags a false error.

	Hits (out of a possible 150)	Advice (out of a possible 600)	False Flags (worst score = -150)
PowerEdit	77	223	-16
Correct Grammar	64	237	-8
Grammatik IV	45	164	-5
Electric Webster	44	114	-26
The Writer's Pack (Grammatik IV, Version 1.0)	43	144	-6
Editor	40	119	-12
RightWriter	20	61	-12

OVERALL RESULTS FOR PUNCTUATION, STYLE, AND GRAMMAR



containing words whose spelling resembles the one that was flagged. Then it's up to you. This method makes it difficult to find correct alternatives. This problem contributed to *Electric Webster's* low score (47.5) on the spelling performance test. After the spell-check, you go to a hyphenation routine and can then move to the grammar module. Here the errors are displayed in context, and you can revise your document according to the program's advice. Usually, *Electric Webster* doesn't offer much more than occasional terse suggestions for revisions. As a result, you'll find it unsuitable as a style manual.

Electric Webster did fairly well on some of the grammar tests, detecting errors in 24 percent of the sentences it analyzed. But it received bad scores in the false-flagging category, the tally of suggestions for unnecessary changes. With the default settings for grammar checking, *Electric Webster's* ratio of finding actual errors compared to finding nonexistent errors was close to 1:1, mainly because it kept detecting nonexistent homonym errors. Even after disabling the routine for flagging homonyms, *Electric Webster* had a 2:1 hit to false-alarm ratio, one of the worst in the group.

Electric Webster's modest virtues are overwhelmed by its shortcomings. These include cumbersome operation, a dull interface, a dearth of convenience features, and an occasional tendency to crash. Figure in its high price tag and it becomes the least appealing of all the grammar checkers.

Suitability to Task

Electric Webster

Grammar checker	2
Spell-checker	2
Thesaurus	N/A
Dictionary	N/A
Style guide	N/A

In Short: A spell-checker, hyphenation checker, and grammar checker that gets fair results given its small size. However, *Electric Webster* is plagued by numerous problems, including a high rate of flagging nonexistent grammatical errors, sparse advice for correcting grammatical errors, and an interface that only sometimes lets you see your errors in context.

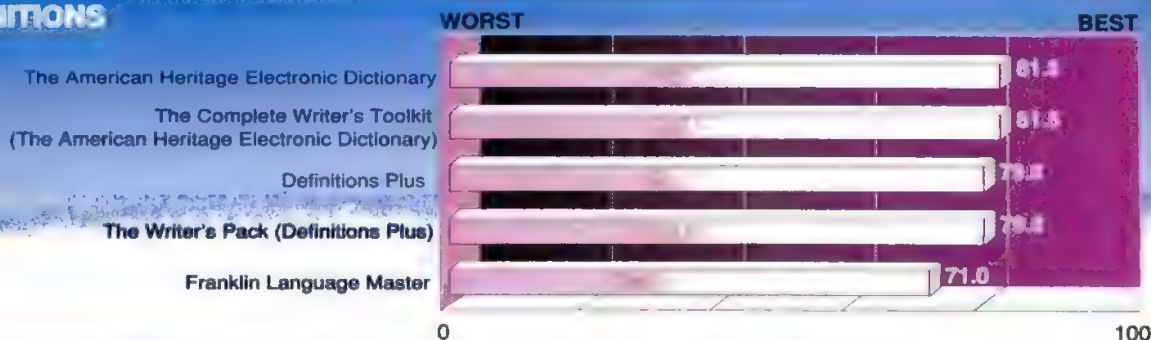


PERFORMANCE TESTS: WRITERS' TOOLS WITH DICTIONARIES

Writers' tools that include dictionaries performed fairly well on our grab-bag test of 100 words, with *The American Heritage Electronic Dictionary* edging out its competitors.

In the **Dictionary Performance** test, the programs are required to define 100 words in a variety of categories. The standard of comparison for this test is a printed desk dictionary, and the highest possible score is 100 points.

DEFINITIONS



DICTIONARY PERFORMANCE: A LISTING OF TEST WORDS BY CATEGORY

Denotations and nuances:

These words test a dictionary's ability to define a common word's different meanings and shades of meaning. *Score:* 0 to 4 distinctions—0 points; 5 to 9 distinctions—0.5 point; 10 or more distinctions—1 point.

- bear
- deal
- fly
- gain
- mark
- play
- rest
- roll
- sound
- throw

Obsolescent words:

These words test a dictionary's ability to define words that are on the verge of becoming obsolete. *Score:* 1 point for every word defined.

- behoove
- betwixt
- espy
- forsooth
- fourscore
- knave
- saith
- swoon
- twain
- wherefore

New words:

This selection tests the ability of a dictionary to define the new words that have entered the English language since 1950. *Score:* 1 point for every word defined.

- biodegradable
- computerize
- disco
- Eurodollar
- glitch
- hardhat
- hawkish
- nuke
- printout
- tokenism

Foreign words:

These words test the ability of a dictionary to define foreign words that have entered the English language. *Score:* 1 point for every word defined.

- caveat
- declassé
- jihad
- nirvana
- obligato
- paella
- politesse
- realpolitik
- samurai
- vinaigrette

Rare words:

These words test the ability of a dictionary to define rare words. *Score:* 1 point for every word defined.

- dilatory
- flaccid
- jejune
- lachrymal
- malefaction
- notional
- otiose
- redivivus
- supererogate
- teleological

Professional words:

These words test the ability of a dictionary to define professional terms. *Score:* 1 point for every word defined.

- certification
- deposition
- histology
- impanel
- neural
- pandemic
- riparian
- taxiway
- Teletype
- ultrasound

Business words:

These words test the ability of a dictionary to define business words. *Score:* 1 point for every word defined.

- conglomerate
- divestiture
- enablement
- entitlement
- ergonomics
- fiduciary
- foreclose
- mortgagee
- privatization
- workstation

Colloquial words:

These words test the ability of a dictionary to define colloquial words. *Score:* 1 point for every word defined.

- bafflegab
- frazzled
- hype
- jerkwater
- jollies
- loco
- scam
- snitch
- tizzy
- zippy

Scientific and technical words:

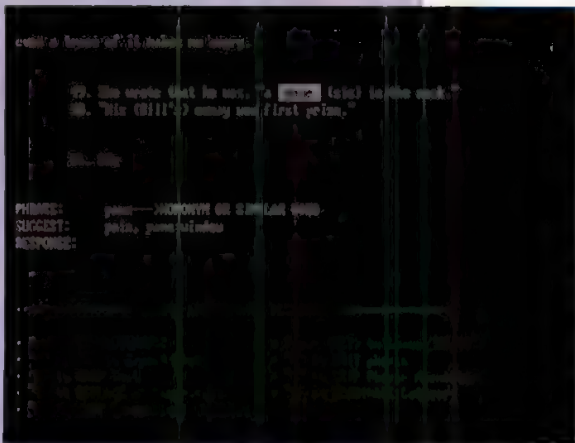
These words test the ability of a dictionary to define scientific and technical terms. *Score:* 1 point for every word defined.

- biosphere
- dicotyledon
- impedance
- lithosphere
- mitosis
- neuron
- radioisotope
- seismograph
- tritium
- valance

Irregular plurals:

These words test the ability of a dictionary to furnish unusual plural forms. *Score:* 1 point for every word for which plurals are given.

- alumna
- appendix
- beau
- ellipsis
- octopus
- opus
- radius
- stimulus
- stratum
- vertebra



During its grammar-checking phase, *Electric Webster* highlights a possible error in your text, gives a brief explanation of the problem, and suggests a correction (if one is available).

Electric Webster, Version 2.0

Cornucopia Software, P.O. Box 6111, Albany, CA 94706; 415-528-7000.

List Price: \$129.95.

Requires: 256K RAM, DOS 2.0 or later.

CIRCLE 403 ON READER SERVICE CARD

Franklin Language Master



Franklin Language Master, Version 3.0, combines two different Merriam-Webster reference works: *Webster's Electronic Dictionary*

and *Webster's Electronic Thesaurus*. Formerly published by Proximity, the set now sold by Franklin Electronic Publishers for \$79.95, is compatible with most major word processors and is available in a *Microsoft Windows* version.

TOP TEST SCORES

Webster's Electronic Thesaurus claims a very large lexicon of 1.4 million terms and 40,000 entry words. This explains how it beat all four competitors on the performance tests, scoring a very respectable 67 points. The thesaurus was particularly adept at finding synonyms for common terms, modifiers, and rare words. Its

weakest category was professional terms; it was unable to provide synonyms for such words as "automate," "diagnosis," and "prosecution."

In *Webster's Thesaurus* synonym window it's usually impossible to see your entry word in context, but you can toggle to a full-screen window to display your original document. The program offers a good manual, intelligent keyboard as-

signments, and logical commands. It has many handy features, such as help and look-up windows, antonym listings, and synonym chaining (the ability to get synonyms for words in synonym listings).

When the program can't recognize an entry word, it suggests alternatives with similar spellings. It's also smart enough to preserve capital letters and plurals. However, the program does not support automatic "a/an" transitions, and not all of its entries are absolutely accurate. For example, a definition given for "czar" was "a businessman of exceptional wealth, influence, or power," but common usage ("drug-enforcement czar") suggests that the word has a broader meaning. The only other less-than-satisfactory aspect of *Webster's Thesaurus* is that it forces you to go through a definitions menu before reaching the synonyms window, especially since the program's quick-exit command doesn't work properly. But this only adds a few seconds to synonym retrieval, a price worth paying for an otherwise first-rate thesaurus.

TWO WEBSTER'S IN ONE

The companion program, *Webster's Electronic Dictionary*, is integrated with the thesaurus, so when you load the program you can display one or call one up from inside the other. The interfaces for the two are similar, and whenever possible the commands are duplicated.

As a definitions dictionary, *Webster's Dictionary* doesn't quite reach the top. It earned 71 points on the dictionary test, a decent score but well behind *The Ameri-*

Suitability to Task

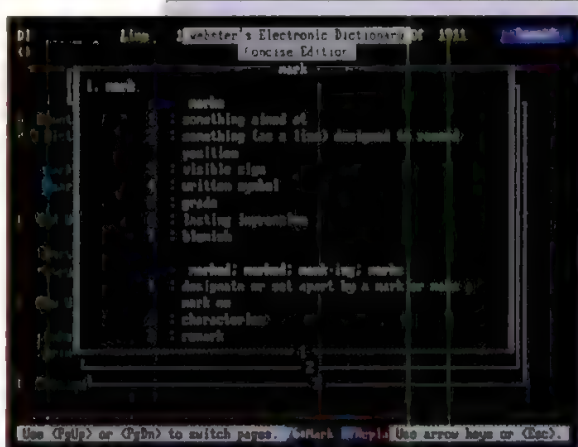
Franklin Language Master

Grammar checker	N/A
Spell-checker	1
Thesaurus	4
Dictionary	3
Style guide	N/A

In Short: A package that combines a first-rate thesaurus and a good dictionary, *Franklin Language Master* is easy to use and fast. While its dictionary is not the best, it will still give you the information you need. A *Microsoft Windows* version is available.

can Heritage Dictionary's 81.5. This result shouldn't be surprising, since *American Heritage* claims a lexicon that's far larger than *Webster's Dictionary*.

Unlike *American Heritage*, *Webster's Dictionary* doesn't offer etymologies or pronunciation guides, and many of its definitions are on the skimpy side. If you look up "gain," you'll get one five-word definition, three one-word definitions, and others that are in-between. For "four-score," the only definition is "80." *Webster's Dictionary* also lacks many of the special features in *American Heritage*,



Webster's Electronic Dictionary, a program in the *Franklin Language Master* package, pops up over your word processor. This display indicates that the dictionary can give you two more screens with definitions for the word "mark."

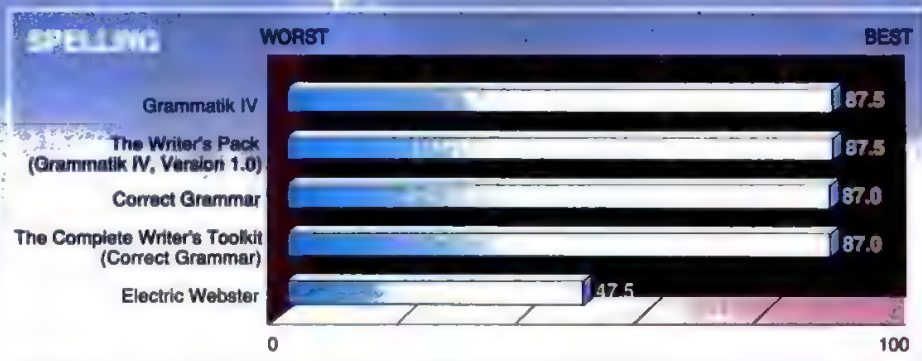


PERFORMANCE TESTS: WRITERS' TOOLS WITH SPELL-CHECKERS

The best spell-checkers are included in two grammar-checking programs: *Grammatik IV, Version 2.0*, and *Correct Grammar*. Scores are higher here than on the grammar tests because spell-checkers do not have to struggle with sentence parsing and illogical language rules.

In the **Spell-Checker** performance test, 100 misspelled words grouped into ten categories are run through the programs. One-half of a point is obtained if the program recognizes a misspelled word, and another half point is given if the program automatically suggests a correct alternative.

The standard of comparison for this test is a printed desk dictionary, and the highest possible score is 100 points. Programs that can detect only commonly misspelled words were not considered as a substitute for full-featured spell-checkers and were not evaluated here.



SPELL-CHECKER PERFORMANCE: A LISTING OF TEST WORDS BY CATEGORY

Simple spelling errors:

- hte (the)
- freind (friend)
- wrtie (write)
- strikeing (striking)
- revisd (revised)
- senator (senator)
- problme (problem)
- advertize (advertise)
- cieling (ceiling)
- centerign (centering)

Common words often misspelled:

- embarass (embarrass)
- wierd (weird)
- salery (salary)
- minature (miniature)
- inovate (innovate)
- sizible (sizable)
- government (government)
- paralell (parallel)
- sepearate (separate)
- knowlege (knowledge)

Less-common words often misspelled:

- anihilate (annihilate)
- innoculate (inoculate)
- catalist (catalyst)
- delapidated (dilapidated)
- parafin (paraffin)
- naptha (naphtha)
- desiccate (desiccate)
- sacreligeous (sacrilegious)
- hypocrcacy (hypocrisy)
- millenium (millennium)

Abbreviations with or without periods:

- U.N.E.S.C.O. (UNESCO)
- Dr (Dr.)
- C.I.A. (CIA)
- PhD (Ph.D.)
- N.A.A.C.P. (NAACP)
- km (km.)
- Y.M.C.A. (YMCA)
- pm (p.m.)
- C.B.S. (CBS)
- DDS (D.D.S.)

Common proper nouns:

- Roebrt (Robert)
- Suzan (Susan)
- Jones (Jones)
- Wislon (Wilson)
- Brasil (Brazil)
- Japinese (Japanese)
- California (California)
- Florida (Florida)
- Pheonix (Phoenix)
- Maimi (Miami)

Words ending in ance/ence, ible/able:

- substence (substance)
- defensable (defensible)
- concurrence (concurrence)
- compensible (compensable)
- grievence (grievance)
- tangible (tangible)
- preferance (preference)
- erasible (erasable)
- inheritence (inheritance)
- reversable (reversible)

Foreign words:

- aparthied (apartheid)
- kamikazi (kamikaze)
- detante (detente)
- sputnick (sputnik)
- svelt (svelte)
- bario (barrio)
- blitzkreig (blitzkrieg)
- allfresco (alfresco)
- fortisimo (fortissimo)
- koshar (kosher)

Scientific and technical words:

- manameter (manometer)
- oscilloscope (oscilloscope)
- quarke (quark)
- pharminology (pharmacology)
- rhizome (rhizome)
- rotagravure (rotogravure)
- sociopath (sociopath)
- taxinomic (taxonomic)
- amphibotic (amphibiotic)
- bronchole (bronchiole)

Business words:

- assesment (assessment)
- demonetization (demonetization)
- deductable (deductible)
- entrepreneur (entrepreneur)
- insurence (insurance)
- erganomic (ergonomic)
- indemify (indemnify)
- invester (investor)
- mercantile (mercantile)
- comodities (commodities)

Hyphenated compound words:

- jack-o-latern (jack-o-lantern)
- knight-errent (knight-errant)
- long-distance (long-distance)
- court-martial (court-martial)
- cross-exaimne (cross-examine)
- ever-recurring (ever-recurring)
- pall-mell (pell-mell)
- old-worlde (old-world)
- roler-skate (roller-skate)
- savoir-fair (savoir-faire)

A close-up, high-angle photograph of an Intel ZEOS 386SX microprocessor mounted on a green printed circuit board (PCB). The processor is a black square chip with gold pins, featuring the 'intel' logo and technical markings such as 'NG80386SX-20', '18.88', '© 1988', and 'TEP 87'. The PCB is densely packed with various electronic components, including capacitors and other integrated circuits, with labels like 'U20' and 'U17' visible. The lighting is dramatic, with strong highlights and deep shadows, emphasizing the intricate details of the hardware.

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drive interface right on the motherboard. This not only saves you an expansion slot but enables us to provide you with the very latest (and fastest) IDE disk drives as well. Not only that, but your system will also accommodate additional hard drive technologies (including ESDI, SCSI, etc.) should you wish to add them. And your ZEOS Advanced Engineering Advantage

of pure clean power. This isn't some cheap power supply used to keep the price down—this is the *very best*. Because the very best is just what your system deserves. It deserves to live a long time too.

EXTRA COOLING. LONGER LIFE.

That's why you'll receive the unique *patent pending* ZEOS cooling system. This includes not just one but *two* whisper quiet cooling fans. Why two fans? Because we know that if, as an

Performance. Quality. Price. Support.

doesn't stop there.

On the I/O (Input/Output) side, we've freed up another slot for you too. We've taken the celebrated high speed ZEOS I/O card and put it right on the motherboard. The result is two fully software configurable *high speed* serial ports, the parallel port and even a game port *built right into* the motherboard!

ROOM TO EXPAND. POWER TOO.

If you should open up your system you'll see expansion room galore. Because at ZEOS, we always give you room to grow. That isn't just limited to more open expansion slots either. We give you our SpaceSaver case which has *seven* drive bays yet is *smaller* than most full size cases that have only five drive bays. But what of expansion *power*?

Having the room to expand is only part of the story, we give you the *power* to expand as well! Your new ZEOS 386SX-20 will have the best power supply money can buy and this baby will be pumping your system with a full 200 WATTS

example, you lower the ambient interior temperature of your system by 10°C, you can up to double the life of the components inside! Now that's quality. Others don't do it. We do, because at ZEOS providing you with absolute quality and reliability are of primary importance. It's a case of quality. Speaking of which...

The beauty of your ZEOS case is much more than skin deep. The steel ZEOS uses is specified to be 0.20mm thicker than that of cases used by many of our competitors. And the fit is finely crafted to provide a rock solid system while meeting the stringent requirements of our Underwriters Laboratories listings. True, quality touches cost a *little* more but it all adds up to *value*, and *value* is why you're buying a ZEOS system!

Here we have discussed how your new ZEOS 386SX-20 provides you with stellar performance, unequalled quality and absolute reliability. With all of this, what more could there be? From ZEOS lots more.

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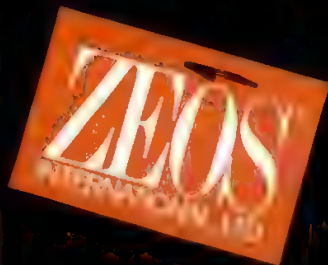
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- ✓ Friendly ZEOS Systems Consultants are available 24 Hours a Day by calling 800-423-5891. You can call any time.

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- Microsoft® DOS 4.01 with Disk Cache Software.



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- Two full Megabytes of High Speed 53ns DRAM.
- A second Teac floppy drive, 3.5", 1.44 MB.
- Microsoft® DOS 4.01 with Disk Cache Software *plus* Microsoft Windows™ 3.0 and mouse!

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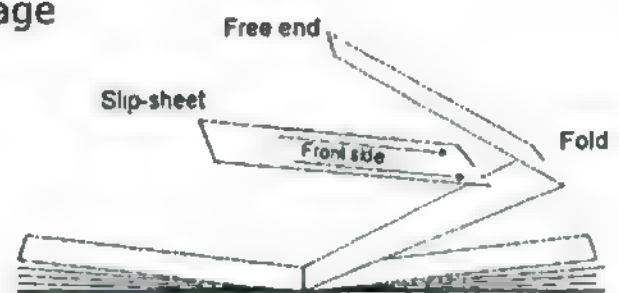
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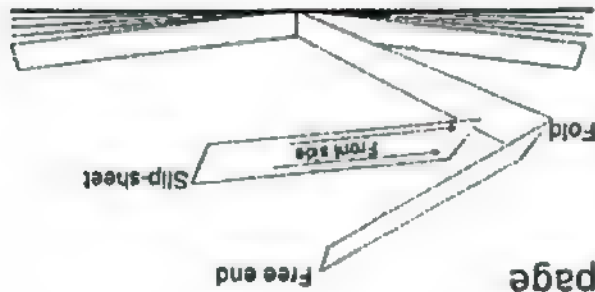
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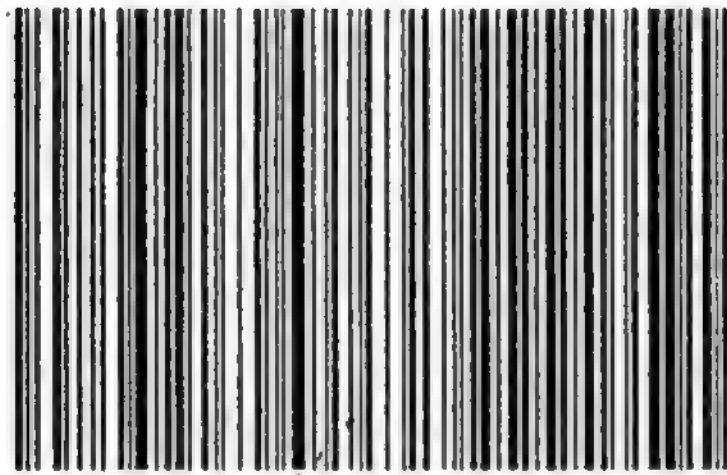
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Gbs5lipBack-0018

Back

1. Follow instructions on the other side



That's right! Now you can own the incredible ZEOS 386SX-20 for as little as \$1195. The price is amazing but that's not all.

Should you decide to purchase it (and we think you will), you will be acquiring the most advanced personal computer system of its kind. Incorporating the very latest in personal computer technology, your new ZEOS 386SX-20 is quite simply the very best you can buy—at any price. Why?

Pe

FAST MEMORY. INCREDIBLE PERFORMANCE.

For starters, we're including incredibly fast *fifty-three nanosecond* DRAM. When we sat down to design this system we polled all the existing technology. We knew that while every 20MHz 386SX processor crunches data at the same rate, making that data available to the processor for immediate crunching is the key. The faster the DRAM (the computer's memory that holds the data for crunching), the faster the data got crunching.

Until now, the best way to get data to a 20MHz processor was to use "cache memory"; the next best is called page/interleaving. Yet a typical cache scheme of say 32K (only 1/16 of a megabyte) holds only a fraction of the memory's data for quick crunching by the processor. The rest of the system's memory is usually only 80 nanosecond (ns) or even slower 100ns DRAM. That's where ZEOS' blazing *53ns memory* comes in.

With the 53 nanosecond memory in your new ZEOS 386SX-20, your system's processor has *instant access* to all the memory in your system—without using a cache. This instant access to *all* your system's memory means your data is available for immediate crunching. Bottom line—an *incredibly* fast computer at a *very* reasonable price.

INCREDIBLY FAST. JUST FOR STARTERS.

Incredibly fast indeed! Yet that's only the start of your new high technology ZEOS 386SX system. We've captured the latest in other technologies as well. Take hard drives for instance.

Your new high speed ZEOS 386SX-20 system includes our IDE hard drive interface and floppy



10 Good Reasons To Buy From ZEOS®

Reason #1

"Overall Excellence."

As *PC Magazine* said "Price is always a consideration. So are benchmark test results. But both factors can be deceiving, which is why we consider them in the context of other aspects that will make the difference months and years down the road."

These are the attributes which *PC Magazine* used in awarding ZEOS the coveted Editor's Choice, not once but *eight* times. And "Overall Excellence" are the very words *PC Magazine* used in describing ZEOS systems comparing them to all others.

Reason #2

Dazzling Performance.

In one recent '386 review, *PC Magazine* awarded ZEOS Editor's Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in another recent review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world."

Dazzling Performance is built into every ZEOS system. It's a key component of ZEOS Overall Excellence.

Reason #3

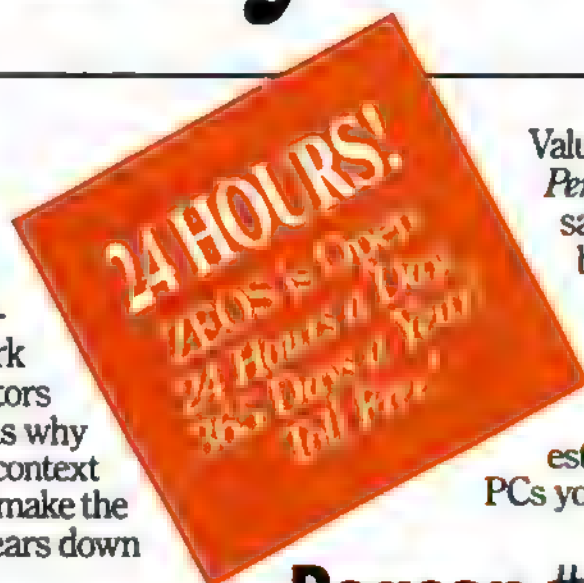
Exceptional Quality.

PC Resource Magazine put it this way, "ZEOS... provides quality comparable with IBM or Compaq and does so for about 70% of the price." ZEOS uses only the very best components. And every system is fully tested and burned-in right in our own labs.

Reason #4

Value.

InfoWorld says, "We find the ZEOS '386 an excellent value. Speed: Excellent. Compatibility: Excellent."



Value: Excellent."

Personal Computing said, "ZEOS... is the best value we've come across... its performance is right up there with the slickest, most expensive PCs you can buy."

Reason #5

Warranties and Guarantees.

ZEOS believes in its products. That's why we offer each and every customer our 30 Day Absolute Satisfaction Money Back Guarantee, no questions asked. Plus, our One Full Year Limited Warranty and Express Parts Replacement Policy. Optional On Site Service is available too. Call for details.

Reason #6

24 Hour Toll Free Technical and Sales Support.

At ZEOS, the customer is #1. That's why we invented 24 Hour a Day Tech Support. For *your* convenience. If you buy a product from us we feel we should be there to help, any time of the day or night. Give us a call Toll Free! 800-423-5891. Anytime!

Reason #7

Experience.

Almost unique in the mail order computer industry, ZEOS maintains its own chip level Research and Development staff. In addition to Systems Manufacturing, we also operate our own Board Level Manufacturing facility.

ZEOS has been involved in Research and Development since our incorporation back in 1981. Our strong and experienced Research, Manufacturing and Technical Staff translates into superior factory direct computer systems for you.

Reason #8

A Sterling Reputation.

In magazine after magazine and review after review ZEOS systems are cited for Overall Excellence, for Excellent Value, as the Right Choice and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The systems and the support. That means more to us than anything.

Reason #9

Easy to Buy.

ZEOS systems are easy to buy. You can pick up the phone any time of the day or night and order your new ZEOS computer. And we accept MasterCard, Visa, Discover, American Express, and Corporate Purchase Orders from Fortune 1000 Companies, Colleges, Universities and Governments. Complete Leasing Programs are available as well.

And now the Z-CARD! It's your very own ZEOS Credit Card and you can apply today. With the Z-CARD you can charge your ZEOS purchases and pay in easy monthly installments. It's just like a Bank Card. Why not apply for your Z-CARD now!

Reason #10

You're Going to be Very Satisfied.

When it comes right down to it, you're going to be very satisfied with your new ZEOS system. Our goal is your complete satisfaction. And that's our commitment to you. To quality. To performance. To reliability and support. To *Value*. We don't just say it, *we Guarantee it!*

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Fill out your Z•Card™ Application and mail it today to ZEOS International, Z•Card Processing Center, 530 5th Avenue N.W.,

St. Paul, MN 55112. We'll give you a call as soon

as your credit line is established!*

Please complete all appropriate sections, *providing at least two years residence and employment history*. **THIS IS NOT A CREDIT AGREEMENT!** One will be sent to you upon authorization of an account. (This Form Must Be Signed To Process Your Order.) All Financed Purchases Are Subject To Credit Approval. **If You Have Any Credit Questions, Please Call 800-421-8942 For Assistance. Thank You!**

A married person may apply for individual credit. I am applying for (please check appropriate box):

- ☐ **JOINT CREDIT** with another person. Complete entire application.
- ☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.
- ☐ **INDIVIDUAL CREDIT.** Do not complete Section C.**

**If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract.

NOTICE TO WISCONSIN APPLICANTS: YOU MUST DISCLOSE YOUR MARITAL STATUS:

☐ married ☐ unmarried ☐ legally separated

A. YOUR PERSONAL INFORMATION

Name _____

Home Phone (_____) _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Since? (Mo./Yr.) _____ ☐ Buy ☐ Rent ☐ Other _____

Previous Address _____

City _____ State _____ Zip _____

Employer _____ Since? (Mo./Yr.) _____

Monthly Gross Salary \$ _____ Daytime Bus. Phone (_____) _____

Previous Employer _____ From - To _____

Occupation _____

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying this obligation.

Additional Monthly Income \$ _____ Source: _____

Name & Address of Nearest Relative Not Living With You _____

Relationship _____

B. CREDIT INFORMATION

PLEASE TELL US IF YOU HAVE: Checking Account ☐ Yes ☐ No Savings Account ☐ Yes ☐ No

	Y/N	How Many?		Y/N	How Many?
Bank Loan	_____	_____	Dept. Store Charge Card	_____	_____
VISA	_____	_____	Credit Union Account	_____	_____
MasterCard	_____	_____	Other Major Charge Cards	_____	_____
Finance Company Loan	_____	_____			

C. JOINT APPLICANT INFORMATION

Joint Applicant's Name _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Home Phone (_____) _____ Date of Residence (Mo./Yr.) _____

Joint Applicant's Employer _____ Since? (Mo./Yr.) _____

Bus. Phone (_____) _____ Monthly Gross Salary \$ _____

CUSTOMER AUTHORIZATION

I authorize ZEOS International, Ltd. or its assignees to investigate credit records and to report my performance hereunder to credit agencies. I hereby certify that the following information is furnished to you for the purpose of obtaining credit and is true and correct to the best of my knowledge and belief.

Applicant's Signature _____

Date _____

Joint Applicant's Signature _____

Date _____

FOR MARRIED WISCONSIN APPLICANTS:
I acknowledge that the obligation described herein is being incurred in the interest of my marriage or family.

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There are costs associated with the use of this credit card. To obtain more information about these costs, call us at 800-421-8942 or 612-635-0613 or write to ZEOS, Z•Card Processing Center, 530 5th Avenue N.W., St. Paul, MN 55112.

NY—A consumer credit report may be requested in connection with this application or in connection with updates, renewals or extensions of any credit granted as a result of this application. If I subsequently ask for this information, I will be informed whether or not such a report was requested and, if so, the name and address of the agency that furnished the report.

OH—THE OHIO LAWS AGAINST DISCRIMINATION REQUIRE THAT ALL CREDITORS MAKE CREDIT EQUALLY AVAILABLE TO ALL CREDITWORTHY CUSTOMERS AND THAT CREDIT REPORTING AGENCIES MAINTAIN SEPARATE CREDIT HISTORIES ON EACH INDIVIDUAL UPON REQUEST. THE OHIO CIVIL RIGHTS COMMISSION ADMINISTERS COMPLIANCE WITH THIS LAW

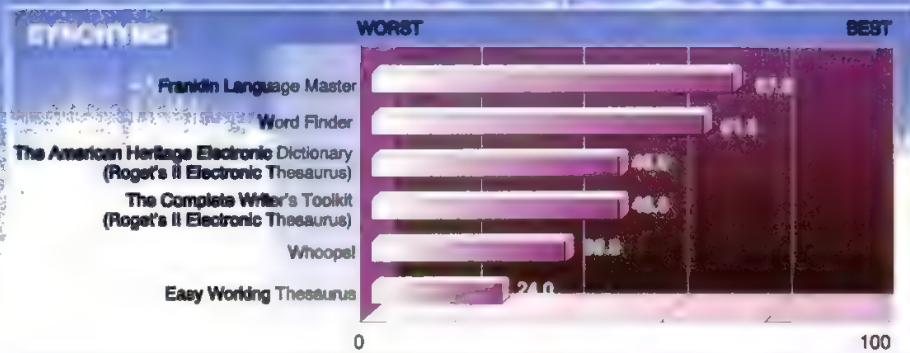
*Financing not available in Alaska, Hawaii or outside the continental U.S.



PERFORMANCE TESTS: WRITERS' TOOLS WITH THESAURUSES

The two highest-scoring thesauruses have very different styles. *Franklin Language Master* has a deep and diverse lexicon, while *Word Finder* overwhelms you with the sheer number of synonyms it provides. The other four thesauruses do not perform nearly as well.

In the *Thesaurus* performance test, the programs are required to provide synonyms for 75 words in a variety of categories. The standard of comparison for this test is a printed desk thesaurus, and the highest possible score is 100 points. One point is awarded for finding each synonym to a word, except where noted.



THESAURUS PERFORMANCE: A LISTING OF TEST WORDS BY CATEGORY

Common words with meanings as nouns and verbs: These words measure the number of synonyms a thesaurus can provide for words with dual meanings. *Score:*

0 to 9 words—0 points;
10 to 19 words—1 point;
20 to 29 words—2 points;
30 to 39 words—3 points;
40 to 49 words—4 points;
50 to 59 words—5 points;
60 or more words—6 points.

- arm
- voice
- fence
- link
- stem

Common words with meanings as nouns, verbs, and modifiers:

These words determine whether a thesaurus can provide synonyms for all the grammatical forms of a word. *Score:* 0 to 1 forms—0 points; 2 forms—0.5 point; 3 forms—1 point.

- alert
- fast
- fine
- trim
- champion
- back
- wrong
- head
- plane
- express

Modifiers: These words measure a thesaurus's ability to provide synonyms for modifiers. *Score:* 1 point for each word for which true synonyms—modifiers, not nouns or verbs—are given.

- majestic
- needlessly
- offhand
- headlong
- legendary
- clannish
- corrosive
- eminently
- robust
- skittish

Rare words: Measures a thesaurus's ability to provide synonyms for rare words. *Score:* 1 point for each word for which synonyms are provided.

- rubric
- scintilla
- prolix
- vulpine
- traduce
- ebullience
- ductile
- bovine
- inchoate
- fecund

Professional words: These words measure a thesaurus's ability to provide synonyms for professional terms. *Score:* 1 point for each word for which synonyms are provided.

- jurist
- federation
- automate
- prosecution
- malpractice
- therapeutic
- bequest
- symposium
- diagnosis
- administrator

Business words: These words measure a thesaurus's ability to provide synonyms for business terms. *Score:* 1 point for each word for which synonyms are provided.

- invoice
- financial
- profit
- appraise
- manufacture
- equity
- rebate
- debit
- capitalize
- distributor

Colloquial words: These words measure a thesaurus's ability to provide synonyms for colloquial terms. *Score:* 1 point for each word for which synonyms are provided.

- gab
- jive
- loony
- mom
- boondoggle
- whack
- savvy
- scalper
- buddy
- blab

Foreign words: These words measure a thesaurus's ability to provide synonyms for "foreign" terms. *Score:* 1 point for each word for which synonyms are provided.

- gracias
- finis
- gaffe
- kowtow
- piazza
- ersatz
- czar
- soupcon
- hula
- maharajah

THE FINE ART OF DISC DRIVES



An artist applies special techniques in

order to create a work of art. Similarly, Seagate has blended a number of advanced technologies into the Swift® family of high-performance 3.5" disc drives.

Designed expressly for high-end PCs and workstations, these half-height drives range in capacity from 80 to 210 megabytes formatted. The drives are available in industry standard ST412, SCSI, AT and ESDI interfaces, which means there is a Swift drive for every application. Our top-of-the-line ST1239, for example, comes in both AT and SCSI versions, making it an ideal drive for advanced workstations.

And it's no coincidence that these drives are named Swift: every drive in the family boasts a 15 msec. average access time. They also feature Seagate's proprietary thin-film discs, spindle motors, rotary voice coil actuators and patented dedicated servo technology for maximum performance and reliability.

No one knows more about the fine art of disc drives than Seagate. For complete product specifications, contact your authorized Seagate distributor, or call Seagate directly: 800-468-DISC, or 408-438-6550. But don't delay; like their name, these drives are bound to go fast.



Seagate

SOFTWARE WRITERS' TOOLS

such as Boolean searches through the dictionary's definitions and an anagram creation routine.

Franklin Electronic Publishers should soon be announcing a new version of *Franklin Language Master*. Promised enhancements include a 10K RAM requirement, movable synonym windows, a fix for the quick-exit command, a more-efficient interface, and an enlarged dictionary. Should you delay buying the program until the new version starts shipping? As the original Mr. Franklin said, "A word to the wise is enough."

Franklin Language Master, Version 3.0

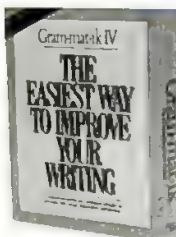
Franklin Electronic Publishers Inc., 122 Burrs Rd., Mount Holly, NJ 08060; 800-543-3511.

List Price: \$79.95.

Requires: 109K RAM, 1.8MB available disk space, DOS 2.0 or later.

CIRCLE 404 ON READER SERVICE CARD

Grammatik IV



Grammatik is the name that usually comes to mind when people think of grammar checkers, and it often makes the software best-seller lists. One reason for *Grammatik IV*'s success is its

support for a wide variety of word processors—25 in all. The *Windows* version of

the package can be seamlessly integrated into *Microsoft Word for Windows*. Other reasons include its ease of use, its first-rate spell-checker, and the lucid manual that Reference Software International designed into this \$99 package. It's considerably faster than its nearest rival, *Correct Grammar*, and it performs well even on slow machines.

For all these advantages, though, not everything in *Grammatik IV*, Version 2.0, is an example of brilliant software design. The command for toggling the spell-checker will have you scratching your head, but aside from a few other minor quirks, this is a pleasant, well-behaved program.

RELIABLE ADVICE

You can work with *Grammatik* interactively or ask it to mark up a copy of your text. Setting the rules for different writing styles is simple, and its advice about corrections is good enough that you can use it as a substitute for a style manual. Like many grammar programs, *Grammatik* displays a series of readability indexes after analyzing your document.

Grammatik's popularity might suggest that it is also best at detecting grammatical errors. However, its 26 percent score for hits was lower than that of *PowerEdit*, which scored 45 percent, and *Correct Grammar*, which scored 35 percent. Other performance scores were, for the most part, similarly below those of the other two programs. At times, *Correct Grammar* could spot two examples of a certain error where *Grammatik* found only one. In other areas the performance of the two packages was similar.

A COMPARATIVE VALUE

Unless you have the relatively heavy-duty hardware platform that is needed to run *PowerEdit*, your best choices for a grammar program are *Grammatik* and *Correct Grammar*. *Grammatik* is superior at indicat-

ing when numbers need to be spelled out and at detecting split infinitives, while *Correct Grammar* does a better job with sentence fragments, colloquialisms, and nonstandard verb forms ("he runned after the dog").

Suitability to Task

Grammatik IV

Grammar checker	3
Spell-checker	4
Thesaurus	N/A
Dictionary	N/A
Style guide	2

In Short: A popular grammar checker with performance scores somewhat lower than those of two rival programs. The reasons for its popularity include an attractive interface, ease of use, speed, and a very good spell-checker. A *Microsoft Windows* version is available at the same price.

Both programs' spell-checkers received high scores for accuracy, but *Grammatik*'s is faster and easier to work with. For example, when *Grammatik* detects a spelling error, it automatically suggests alternatives, while *Correct Grammar* makes you enter an extra command.

If your main concern is accuracy, you should choose *Correct Grammar*, though its margin of superiority over *Grammatik IV* is small, and neither program can prevent a significant number of errors from slipping by. If speed and ease of use will influence how often you use a grammar checker, you may be better off with *Grammatik*.

Grammatik IV, Version 2.0

Reference Software International, 330 Townsend St., #119, San Francisco, CA 94107; 800-872-9933, 415-541-0222.

List Price: \$99.

Requires: 512K RAM, 4.75MB available disk space, DOS 2.0 or later.

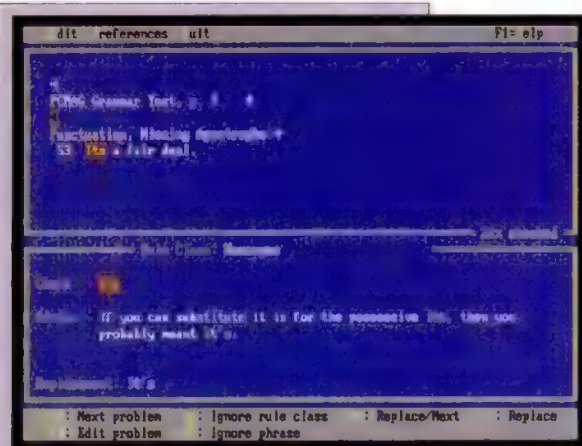
CIRCLE 405 ON READER SERVICE CARD

Infodesk



Infodesk from Microlytics is a set of three interrelated programs: *The Elements of Style*, Version 1.0, (\$59.95), an electronic com-

position handbook; *The Random House*



Grammatik IV, Version 2.0, divides the screen into windows: The upper window shows a portion of your document, and the lower one identifies errors and offers advice for corrections.

SOFTWARE WRITERS' TOOLS



Elements of Style, a program in the Infodesk series, displays the contents of the style manual at the top of the screen and a few lines from the selected topic in a window at the bottom of the screen. Hitting Return will display the information in a full-screen window.

Encyclopedia Electronic Edition, Version 1.0, (\$119), a condensed version of the well-known encyclopedia; and *Inside Information*, Version 1.0, (\$119), a dictionary of terms from various fields of knowledge. All the programs share the same interface, so after learning one, you'll be able to run the others immediately. Unlike *The Complete Writer's Toolkit*, the modules aren't bundled in a single package. When you buy one of them, you can buy the others at a 50 percent discount.

COMBINING CLASSIC WORKS

The Elements of Style is based on the classic work by William Strunk and E.B. White, one of the few writing manuals ever to become a best-seller. The entire text of the book is preserved, although the index has been removed and some of the headings have been shortened. In place of the index, the program has a reverse dictionary—a retrieval engine that helps you find references to various subjects.

Smaller than most electronic style manuals, *The Elements of Style* covers only the most common errors, and lacks the extras such as directories of foreign terms or ZIP codes that are included in rival programs. Strunk and White's book is excellent, compact, easy to use, and cheap, which makes buying the electronic version an uncertain proposition.

The 5.6MB 1-million-word *Random House Encyclopedia* is a condensed version of the 2,700-page, 3-million-word printed edition, with much of the information taken from the "Alphapedia" section of the original. The electronic edition does not have pronunciation guides, bibliographic entries, illustrations, or maps. Compared with the single-volume *New Columbia Encyclopedia*, this reference has about half the entries, and they run about one-third the length.

REVIEW HISTORICAL EVENTS

Any lack of depth is offset by the package's impressive retrieval capability. For example, you can view articles that deal directly with a topic together with articles in which the topic is indirectly discussed. A search for a historical figure will generate a main entry as well as a series of articles on that person's background. By typing in a date, you will get a list of the important events that occurred during that year. Another feature, called Time Chart, lets you review major events in chronological periods.

The encyclopedia also displays hundreds of references to frequently discussed topics. For instance, a listing for World War II can be narrowed down by using Boolean operators to search for a topic and subtopic. Or you can retrieve data by looking through lists of logical categories such as the arts, sports, and leisure. *The Random House Encyclopedia* is an impressive, informative electronic reference work surpassed only by its CD-ROM counterparts.

A WORD LOVER'S LEXICON

Inside Information is a new type of writers' tool called a hierarchical dictionary. It's not meant to replace a conventional dictionary. Rather, it's a supplement that clusters words by meaning. Like *The Random House Encyclopedia*, *Inside Information* is a large program that takes up 3.5MB of hard disk space. (The manual incorrectly states that the program requires 5.6MB.)

After starting *Inside Information*, you move through a tree-structured set of topic headings that lead you to a specific word

list. To display a list of words relating to "Electricity and Magnetism," you'd begin with "Science and Technology," then go through "Physical Science" and "Physics," and then hit your destination word list to get "acceptor, adhesion, ampere, angstrom, etc."

To access a word list directly, you can use an alternative search routine. In all, there are seven classes of words, 20 subclasses, 125 categories, and 700 subcategories; each subcategory yields a list of up to 200 terms and definitions.

Inside Information offers a fascinating variety of topics: genetics ("adaptation, adenine, allele"), synthetic fibers ("acetate, Banlon, acrylic"), world currencies ("afghani, austral, baht, balboa"), and even police procedures ("APB, AKA, alias, apprehend"). A chart of all the headings is in the manual but unfortunately is not available on-screen. Although most of the terms in *Inside Information* are accompanied by definitions, the more common terms are left undefined. You can print individual definitions or save them to an ASCII file, but you can't print or save the word lists.

If you're a word lover, you'll have fun with *Inside Information*. It's hard to resist browsing through lists of related words and looking up unfamiliar terms. If you want to build up your vocabulary, this may be the program of your dreams.

WINDOWS IN THE WORKS

Infodesk is still in its first release, and like many new programs, it has some bugs. The TSR that lets you run *Infodesk*

Suitability to Task

Infodesk

Grammar checker	N/A
Spell-checker	N/A
Thesaurus	N/A
Dictionary	N/A

Style guide

In Short: *Infodesk* is a series of coordinated on-line reference works from Microlytics. *The Elements of Style*, *The Random House Encyclopedia Electronic Edition*, *Inside Information*, and a topical dictionary. The style manual is less impressive than the two other modules—the first non-CD-ROM electronic encyclopedia and a new type of reference. All three programs use the same interface and employ similar data-retrieval routines.

inside another program will crash if you're running any one of a number of TSRs. (Microlytics is working on a patch to take care of a conflict with the *PC Tools* cache program.) The *Infodesk* printer drivers don't work with standard daisy-wheel printers, the program is unable to execute the DOS Print-Screen command, and the retrieval engine runs sluggishly on AT-class machines. Also, to exit from a word list you must backtrack through all your steps. Commands aren't always intuitive, and more on-screen help is needed.

Microlytics promises that the forthcoming release of *Infodesk* will solve some of these problems and will also add mouse support. The publisher is also planning new reference works for the series, the next is expected to be a home health guide. A *Microsoft Windows* version of *Infodesk* is scheduled for release by the end of this year.

Infodesk

Microlytics Inc., 2 Tobey Village Office Park, Pittsford, NY 14534; 800-828-6293, 716-248-9150.

List Price: *The Elements of Style*, Version 1.0, \$59.95; *The Random House Encyclopedia Electronic Edition*, Version 1.0, \$119; *Inside Information*, Version 1.0, \$119. (Users who purchase one *Infodesk* program can buy the others at half price.)

CIRCLE 406 ON READER SERVICE CARD

PowerEdit

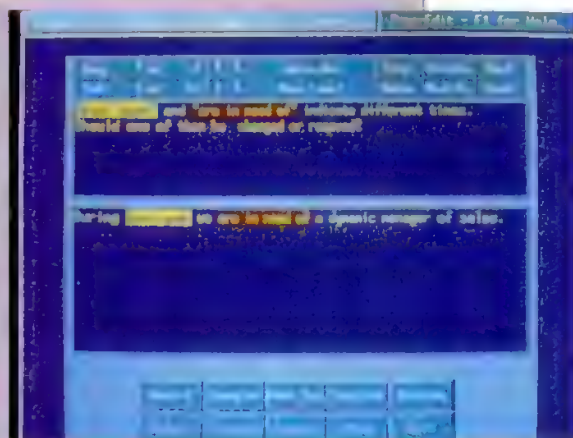


When you start up *PowerEdit*, its attractive interface, which features scroll bars, hour glasses, 3-D buttons, pull-down menus, and pop-up help screens, will really

catch your eye. But *PowerEdit*, Version 1.0, is much more than a grammar checker with a pretty interface. About 16 years in development, this \$295 package from Artificial Linguistics combines a 1-million-word lexicon with an extensive array of algorithms based on artificial intelligence.

PowerEdit is impressive in many ways, not the least of which is its list of hardware requirements. You need 470K RAM, an EGA or VGA monitor, at least a 286-based machine (a 386 machine is better),

SOFTWARE WRITERS' TOOLS



The buttons on the main *PowerEdit* display indicate the variety of options the program offers. A sentence from the original document is displayed in the lower window; advice for emendations appears in the upper window.

1MB expanded or extended memory, and 12MB of hard disk space.

When you ask *PowerEdit* to scan a document, the colorful control panel is replaced by the familiar gloom of a DOS screen. The interruption is a bit disconcerting, and you're left waiting as the program analyzes your document off-screen. On a 33-MHz 386 machine, *PowerEdit* takes 1.5 minutes to scan a 27K ASCII file.

INTELLIGENT EDITOR

Once you start editing your document, the *Microsoft Windows*-style screen reappears, and *PowerEdit* analyzes your text sentence by sentence, flags errors, and suggests corrections. A useful feature is its ability to let you scroll backwards, so you can return to make revisions even after you've moved on to another portion of the document.

PowerEdit detected common grammar and style errors in 51 percent of the test sentences, besting all of its competitors by a wide margin. It was also the only grammar checker that managed to detect more errors than it missed. However, this accomplishment came at the expense of a high rate of false-flagging. When we tuned the program to get it to give fewer false alarms, *PowerEdit*'s success rate dropped to a point where it was only marginally better than *Correct Grammar*.

Even so, *PowerEdit* is the best program in its group. Attractive and easy to use, it can help you with many problems in writing, and its excellent tutorials are often equal to those in electronic style manuals. Most of *PowerEdit*'s suggestions are intelligent, clear, and comprehensive, but a few are vague. A message such as "Rewrite this sentence if necessary" isn't what one would expect from such a classy software package.

DESIGNING EXTRA POWER

Some of *PowerEdit*'s features have yet to be enabled. Foreign-language speakers will eventually be able to display context-sensitive help messages in French, German, Italian, or Spanish. In this version, you can see the buttons that activate this feature but it's inoperative. Future editions of *PowerEdit* will support more word processors and improve on editing and help messages. Also in the works are a *Microsoft Windows* release and an expanded spell-checker. At the moment, *PowerEdit* can only detect 10,000 commonly misspelled words.

PowerEdit's problems have more to do with Version 1.0 traumas than with intrinsic weaknesses. Buried somewhere in those 12MB are the keys to higher levels of error detection. Once Artificial Linguistics properly tweaks, tunes, and tests *PowerEdit*, it's going to set the

Suitability to Task

PowerEdit

Grammar checker	4
Spell-checker	N/A
Thesaurus	N/A
Dictionary	N/A
Style guide	3

In Short: A heavy-duty grammar checker that makes big demands on your system, *PowerEdit* has an excellent *Windows*-style interface and many interesting features. Its grammar-checking performance scores are the highest of the group, although with considerable flagging of nonexistent errors. Keep your eye on this program: Future releases may deliver even better results.



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SOFTWARE WRITERS' TOOLS

standard for efficient, reliable grammar checking.

EDITORS' CHOICE

PowerEdit, Version 1.0

Artificial Linguistics Inc., 2301 N. Akard St., #200, Dallas, TX 75201; 800-800-4254, 214-720-7297.

List Price: \$295.

Requires: 470K RAM, 1MB expanded or extended memory, 12MB available disk space, DOS 3.0 or later. Mouse recommended.

CIRCLE 407 ON READER SERVICE CARD

RightWriter



RightWriter, \$79.95 from Que, approaches grammar checking with a methodology that is different from its competitors. If other programs are like private tutors who go

over your document line by line with you, *RightWriter* is more like a correspondence-school instructor who reviews your work and sends you an edited copy.

At the beginning of a grammar check, *RightWriter* creates an ASCII copy of your file, scans it, inserts recommendations for changes, and appends suggestions for improvements. These include explanations of how to eliminate weak passages and indexes that measure the strength and readability of your writing.

A MULTISTEP PROCESS

Working with *RightWriter* involves a certain amount of exertion. First, you need to wait until the program completes the scanning process. If you own a compatible word processor (*Microsoft Word*, *Multi-stage*, *PFS:Professional Write*, *Q&AWrite*, or *Word-Perfect*), you'll get a file with suggestions for revision in your word processor's native format. If your word processor isn't supported, you must print the marked-up ASCII file. Next, you'll have to enter the suggested changes into your original document. Unlike most grammar checkers, *RightWriter* can't paste amended passages into another file.

At the end of the marked-up file, you'll find a list of words culled from your document and labelled "negative," "colloquial or slang," "often misused," or "possible jargon." Are these actual errors or false flags? To find out, you'll need to perform global searches for each word, since *RightWriter* doesn't mark them in the text or give their locations. The program can't detect spelling mistakes, so you'll have to make another pass through your document with a spell-checker.

Such inconveniences might be forgiven if *RightWriter* were a demon at detecting grammatical problems, but it received the lowest performance scores in its group. Of 150 sentences with grammar errors it flagged 20; of 100 sentences with punctuation mistakes it found only 9. The combined total of 29 hits out of 250 tries represents a success rate of only 12 percent. *RightWriter* and *Electric Webster* shared last-place false-flagging rates of 2:1.

Que thoughtfully includes a paperback copy of Strunk and White's *The Elements of Style* in the *RightWriter* package. If you buy the program, you're going to need the book.

RightWriter, Version 4.0

Que, 11711 N. College Ave., Carmel, IN 46032; 800-992-0244, 317-573-2500.

List Price: \$99.

Requires: 512K RAM, 500K available disk space, DOS 2.0 or later.

CIRCLE 408 ON READER SERVICE CARD



RightWriter, like other grammar checkers, lets you turn rules on and off depending on the style of the text being analyzed. Here the grammar rules are set for the highest degree of error detection.

Whoops!



Cornucopia Software takes the spell-checker that is found in *Electric Webster* (Cornucopia's multipurpose grammar checker), adds a thesaurus, and offers the two utilities as *Whoops!*, Version 3.2.

This \$49.95 package needs a whopping 256K RAM to run as a TSR with its dictionary in memory. You may not have enough room left to run your word processor. You can get around this barrier by using the program in a slower mode that needs between 70K and 82K RAM.

Advertised as a "real-time" spell-checker and thesaurus, *Whoops!* responds audibly when you enter an unfamiliar word such as a proper noun. This audible mode applies only to spell-checking, but considering that its 82,000-word lexicon is comparatively small, you may have to tolerate lots of beeps. The thesaurus, however, is displayed in a conventional way, via hotkey.

SCORES SECOND FROM LAST

Scoring second from last on the thesaurus performance test, *Whoops!* was particularly weak in recognizing rare words and professional terms, and it lacks many

Suitability to Task

RightWriter

Grammar checker	1
Spell-checker	N/A
Thesaurus	N/A
Dictionary	N/A
Style guide	N/A

In Short: *RightWriter* is a noninteractive grammar checker that makes a copy of your file and adds suggestions for improvements. It is hard to use, and its performance scores were below those of rival programs.

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Keyboard	Standard AT-compatible 3mm key travel depth	Enhanced keyboard 2.5mm key travel depth
Memory	1MB expandable to 5MB	2MB expandable to 10MB
Software Incl.	Laplink III MS-DOS Windows 3.0	Not included
Support	Toll-free 800 number On-line modem support	Toll-free 800 number
Price	20MB - \$2799 40MB - \$3099	30MB - \$4399 60MB - \$4999



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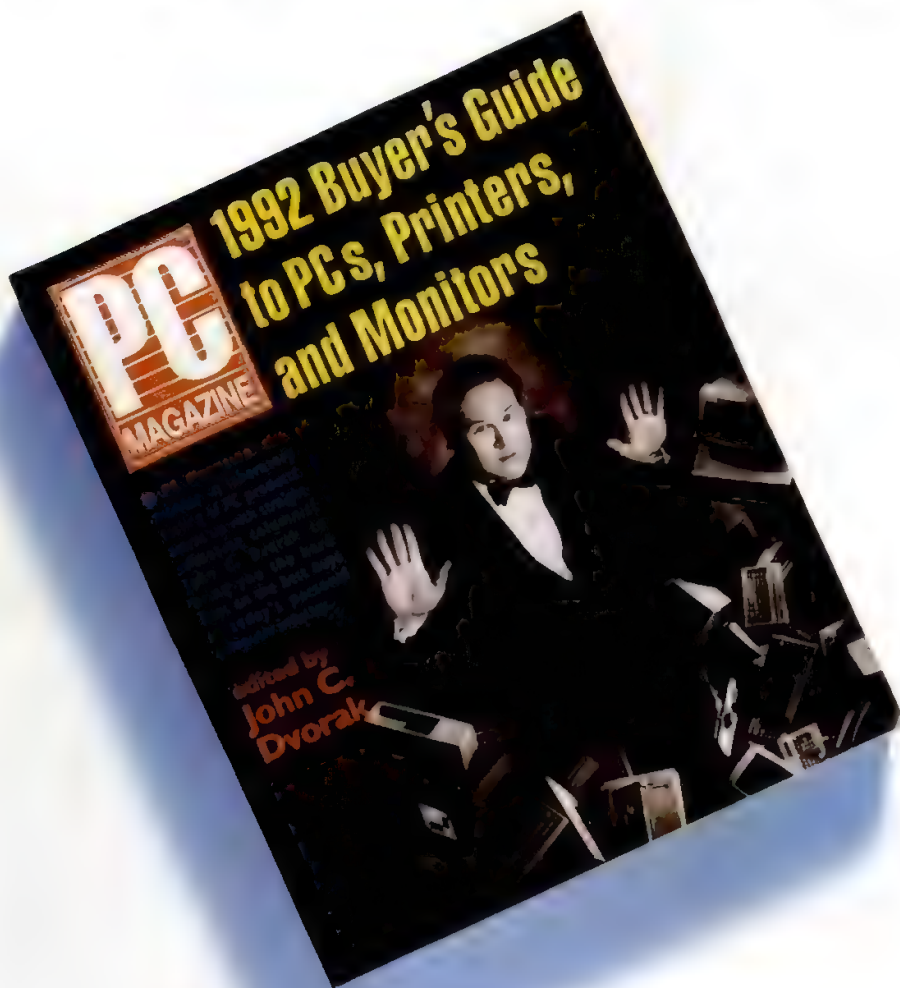
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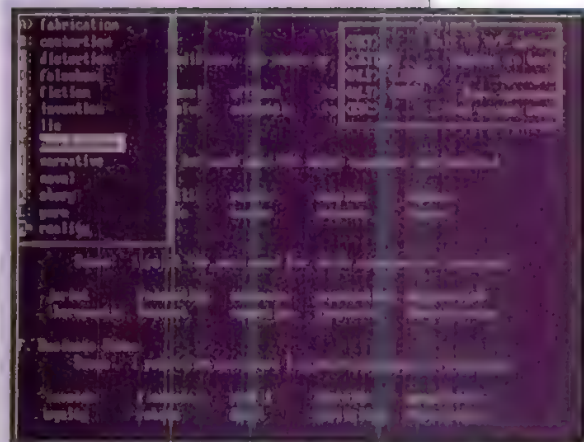
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CIRCLE 517 ON READER SERVICE CARD

SOFTWARE WRITERS' TOOLS



Whoops! displays its synonym list in the upper-left-hand corner of the screen, with the entry word highlighted and asterisks placed before antonyms. To replace a word in your text, you choose the letter before one of the suggested synonyms. A help screen shows other available options.

of the amenities other packages provide. Most programs let you move the cursor to the synonym you want to select, but *Whoops!* complicates the task by making you enter the alphabetic letter that's next to the suggested word.

Whoops! doesn't group synonyms by part of speech or by meaning, can't recognize hyphenated words or plurals, and won't capitalize synonyms when replacing capitalized words. The syno-

nym displays in *Whoops!* are meager and unreliable. Often, words are equated because they have another synonym in common. A "flyer" and a "novel" may both be publications, but are they synonyms?

We discovered many examples of improbable, even goofy equivalents: "offhand" and "voluntary," "piazza" and "balcony," "surveyor" and "head," "hangar" and "parasol." The antonyms are also erratic: "rival" for "buddy," "priceless" for "financial," "fail" for "whack." Nouns are paired with verbs: "refute" and "rebuttal," "solve" and "defense," "react" and "reaction." Liberties are taken even with gender: "czar" is listed as the equivalent of "empress" but, oddly, not of "emperor."

With *Whoops!*, you'll have to deal with lackluster error-detection routines, clunky commands for displaying spelling alternatives, and frequent false flags for words the lexicon can't recognize. And you will probably experience frequent crashes if you try running *Whoops!* under DOS 4.0 or 4.01, a bug Cornucopia hopes to have under control in a future release.

Whoops!, Version 3.2

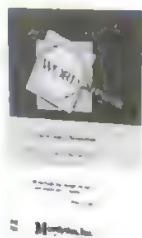
Cornucopia Software, P.O. Box 6111, Albany, CA 94706; 415-528-7000.

List Price: \$49.95.

Requires: 256K RAM, DOS 2.0 or later.

CIRCLE 409 ON READER SERVICE CARD

Word Finder



Forget about fancy touches, just give the people synonyms. This is the philosophy at work behind Microlytics' *Word Finder*, Version 4.0. And that's just what the program provides, supplies, furnishes, and delivers. At first glance, this \$59.95 program won't impress you. The packaging is drab, the manual is drab, and the installation instructions are unclear.

Once you get past first-impressions,

Suitability to Task

Whoops!

Grammar checker	N/A
Spell-checker	2
Thesaurus	2
Dictionary	N/A
Style guide	N/A

In Short: A real-time spell-checker with an integrated thesaurus, *Whoops!* shows low ratings on the spelling and thesaurus tests. In addition, it is difficult to use and vulnerable to crashes if you run it under recent releases of DOS.

Suitability to Task

Word Finder

Grammar checker	N/A
Spell-checker	N/A
Thesaurus	4
Dictionary	1
Style guide	N/A

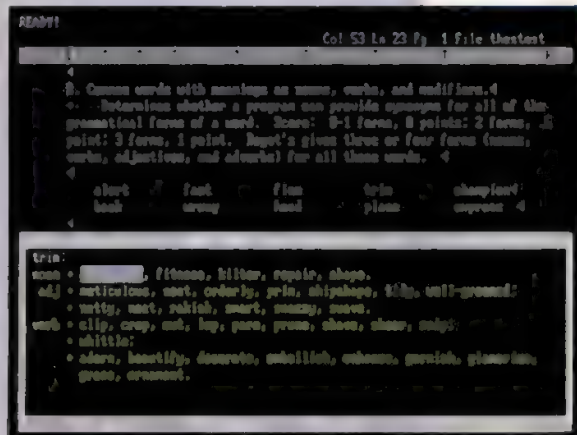
In Short: *Word Finder* is an electronic thesaurus that is short on frills yet capable of delivering the essentials. It is fast and easy to use and has valuable convenience features.

however, you'll discover a crisp program that's easy to use. *Word Finder* runs as a TSR occupying a moderate 32K RAM. On our tests, the program coexisted peacefully with every TSR loaded after it. It's compatible with some 30 other packages, mostly word processors, but also *Lotus 1-2-3*, *SideKick*, and *Symphony*.

To use *Word Finder* from inside another program, you position the cursor at a word and press the hotkey. The synonym window pops up instantly on a 386 machine, and in 2 seconds on a 286 system. If you wish, you can move the cursor to a synonym and hit the hotkey again to see another set of synonyms. When you find the word you want to use, *Word Finder* removes the original term and pastes in the alternative. Then, efficiently, the program exits without waiting for a command. The replacement procedure takes just slightly longer than the routine for displaying a synonym window does.

A PERFECT SCORE

Word Finder did well in many of our thesaurus performance test categories, even earning a perfect score for business terms. Its weakest areas were rare words (it missed "prolix" and "bovine") and foreign terms ("gaffe," "czar"). The program boasts a good stock of synonyms that are based, according to Microlytics, on a 660,000-word lexicon. *Word Finder's* overall score of 61.5, based on its ability to provide synonyms for our 76 test terms, placed it



Word Finder marks the term in your document for which you're seeking synonyms, then pops up over your word processor. Synonyms are listed according to parts of speech, and the lower border of the Word Finder window summarizes the available commands.

Word Finder, Version 4.0

Microlytics Inc., 2 Tobey Village Office Park, Pittsford, NY 14534; 800-828-6293, 716-248-9150.

List Price: \$59.95.

Requires: 30K RAM beyond memory required to run your word processor, DOS 2.0 or later.

CIRCLE 410 ON READER SERVICE CARD

The Writer's Pack



You say you're in the market for writers' tools? Reference Software International has an enticing deal. The same company that markets *Grammatik IV* bundles a group of

tools in *The Writer's Pack* for a \$149 bargain: *Grammatik IV*, Version 1.0 (\$99), WordScience Corp.'s *Definitions Plus* (\$99.95), Digital Learning Systems' *The Associated Press Stylebook* (\$79.95) and *KeyNotes Writer's Handbook* (\$79.95), and *The American Handbook of Business Letters* (\$59).

BARGAIN HUNTER'S FRENZY

You gain about a \$280 savings with this package, but before you're swept up in a bargain-hunting frenzy, consider that you're getting the older version of *Grammatik IV*, not Version 2.0. You'll have to pay another \$29 to upgrade.

Grammatik IV, Version 2.0, enhancements include mouse support, expanded network support, and new error-detection algorithms that improved its scores on our grammar tests. Curiously, Reference Software claims a larger spell-checking lexicon for *Grammatik IV*, Version 2.0, but both versions scored 87.5 on our tests for accuracy in recognizing and correcting 100 misspelled words.

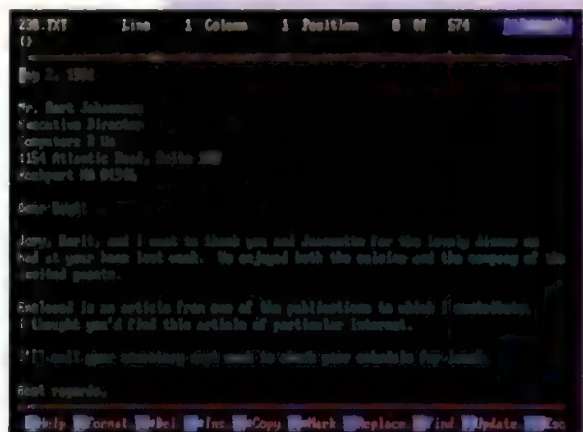
Along with *Grammatik*, *The Writer's Pack* gives you *Definitions Plus*, a very good dictionary. You can find out more about *Grammatik IV* and *Definitions Plus* in our evaluations and test results of the standalone versions.

JOURNALIST'S HANDBOOK

A third item, *The Associated Press Stylebook*, is stocked with useful information: guidelines for business writing, an alphabetized list of punctuation rules, and a dictionary of computer terms. Since the stylebook is designed for journalists, you may find some of its recommendations inappropriate. For this reason the *AP Stylebook* is integrated with *KeyNotes Writer's Handbook*, a general style manual that offers good advice on grammar, punctuation, style, letter writing, research papers, and foreign terms. And if one dictionary of computer terms isn't enough, *KeyNotes* adds another to the package.

Both style manuals have a single interface and similar commands, so it's easy to move between them. You can also use the programs jointly through a routine that lets you search for specific topics in either manual. If you're not sure where to find information about subjunctives, superlatives, or suffixes, the program will quickly take you to entries for these subjects.

The American Handbook of Business Letters is a collection of 257 form letters



The American Handbook of Business Letters, one of the programs in *The Writer's Pack*, offers 257 letters in ASCII format; these can be imported into your word processor and customized.

behind *Webster's Electronic Thesaurus*, which racked up 67 points.

Webster's Electronic Thesaurus is, in fact, the more-powerful of the two programs, but it's also slower than *Word Finder*. With *Webster's*, you have to tab through a definitions menu before you can see any synonyms, and you must use this menu even when there's only one definition for the entry word. *Word Finder's* technique is smoother: It immediately displays clusters of synonyms grouped by meaning. If *Webster's* puts extra cheese on the pizza, *Word Finder* makes the delivery much faster.

The latest version of *Word Finder* has some welcome enhancements. To look up synonyms for a word that's not displayed, just type it. This saves some keystrokes over the earlier method. In addition, *Word Finder* can now change the article before a noun. For example, "a border" is automatically replaced by "an edge." However, it was a surprise to see that this feature didn't work consistently.

Without a hard disk you'll have to get by with a smaller version of the *Word Finder* lexicon—one that contains 360,000 synonyms and provides far less impressive performance. With the complete version, though, you'll quickly discover that *Word Finder* easily lives up to its name.

SOFTWARE WRITERS' TOOLS

Suitability to Task

The Writer's Pack

Grammar checker	3
Spell-checker	4
Thesaurus	N/A
Dictionary	4
Style guide	4

In Short: A five-program bundle that includes a grammar checker (*Grammatik IV*, Version 1.0), a dictionary (*Definitions Plus*), a set of two style manuals (*The Associated Press Stylebook* and *KeyNotes Writer's Handbook*), and a collection of model business letters (*American Handbook of Business Letters* from Nova Development Corp.).

geared to business, professional, and social occasions. To work with them, you need a word processor capable of importing ASCII files. The handbook would be easier to use if a list of contents were available, but you'll have few problems. Except, of course, a lack of originality in

**If you need any three
of the programs in *The
Writer's Pack*, you'll
save money.**

your correspondence.

Should you buy *The Writer's Pack*? If you need any three of these programs, you'll save money—even figuring in the cost of upgrading to *Grammatik IV*, Version 2.0. That may be an offer you can't refuse.

The Writer's Pack, Version 1.0

Reference Software International, 330 Townsend St., #119, San Francisco, CA 94107; 800-872-9933, 415-541-0222. ■

List Price: \$149.

Requires: 512K RAM, 4.75MB available disk space, DOS 2.1 or later.

CIRCLE 411 ON READER SERVICE CARD

Rubin Rabinovitz is a professor of English at the University of Colorado, Boulder. Emerson A. Torgan is an editorial assistant at PC Magazine.

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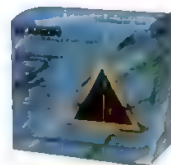
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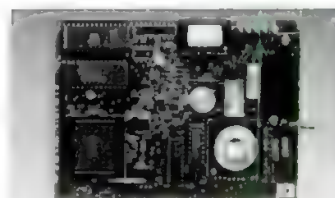


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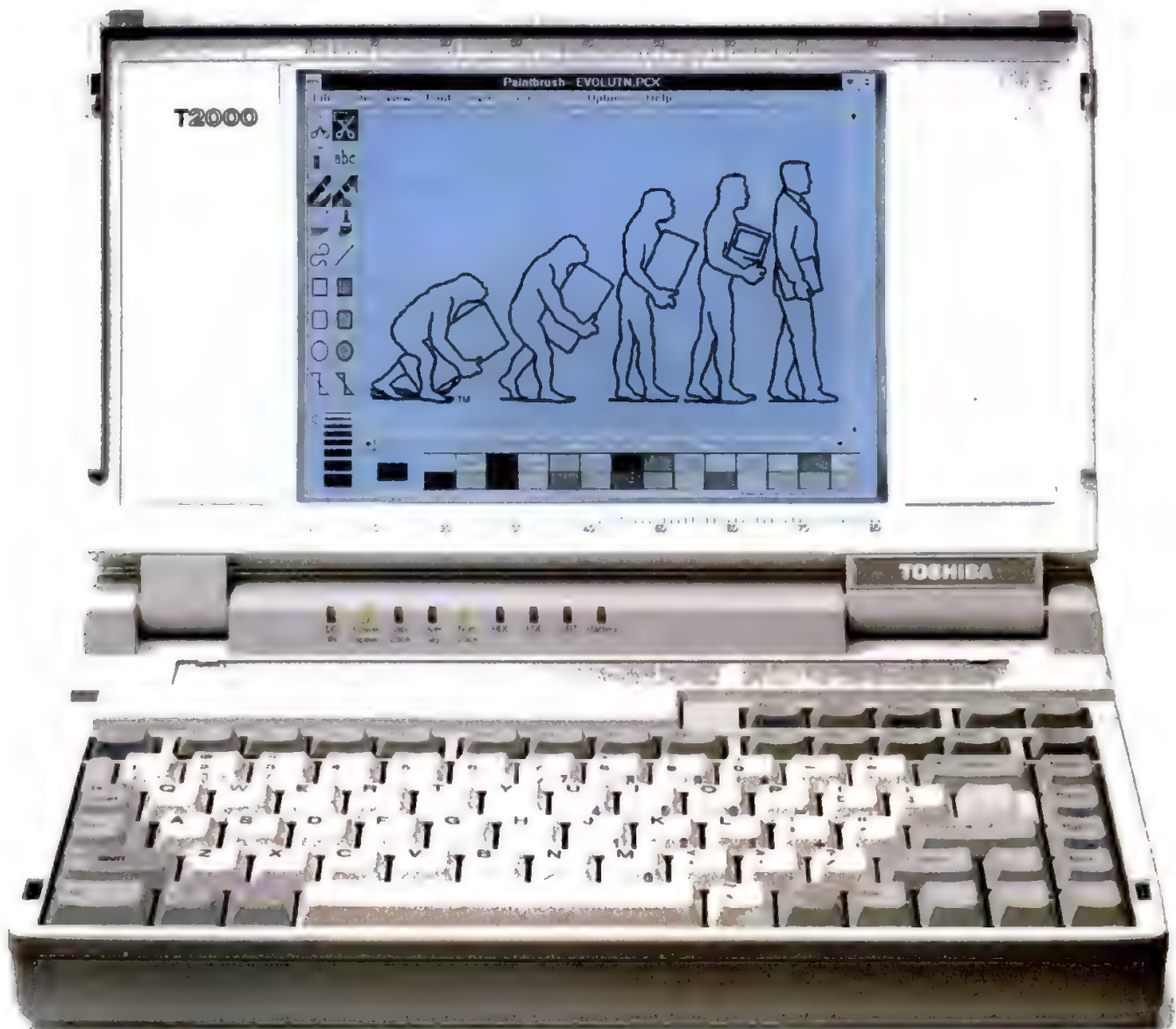


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CIRCLE 379 ON READER SERVICE CARD

The old adage that says you can't be all things to all people is usually doubly true where software is concerned. But Aldus's latest release of PageMaker, with enhanced design tools and long-document capabilities, may be an exception.



PUBLISHING POWER FOR EVERYONE:

PageMaker 4.0 Evens the Score

by Luisa Simone

Aldus's *PageMaker* has long been the preferred tool for design-intensive desktop publishing projects on the PC. Its pasteboard metaphor, which mimics the conventional processes of galley type and mechanicals, appeals to both professional art directors and beginning designers, being familiar to the first group and easily mastered by the second. With its ability to autoflow text in user-defined column guides and wrap it around graphics, *PageMaker* has proved the simplest

and most productive tool for newsletters and a variety of other business documents.

Times change, however, and desktop-published projects have become much more ambitious, both in aesthetic sophistication and in the complexity of documents. *PageMaker*, Version 4.0 for *Windows*, builds upon its traditional strengths with better-than-ever design tools, new support for full-color 24-bit images, robust text-editing functions, sophisticated formatting options, and access to scalable outline fonts via *Adobe Type Manager* (which comes bundled with every copy of the program). More importantly, it comes with brand-new long-document functions, which let you create a totally new kind of *PageMaker* document—one that is truly long yet totally integrated. A newfound ability to link external text, worksheet, and graphics files over a network extends its power into a whole new publishing arena of multichapter books and workgroup projects.

CHALLENGING THE LEADER

In adding long-document support, Aldus avoids direct competition with the accepted king of long documents on the PC, Xerox Corp.'s *Ventura Publisher*. Instead of duplicating *Ventura Publisher*'s features, *PageMaker* 4.0 provides a handful of key functions that Aldus believes will meet the needs of most users, while avoiding the complexity that comes with its competitor's more-advanced capabilities.

For example, one of *PageMaker*'s new commands allows you to generate a table of contents automatically with almost no effort. You instruct *PageMaker* to include a particular text phrase, such as a headline, in the table of contents by checking an option within the Paragraph Style dialog box. When you generate the table of contents, *PageMaker* picks up the designated text blocks, checks on the automatically generated page numbers, and assigns the correct folio to each entry.

Ventura Publisher's facilities, by contrast, are much more elaborate. It can automatically number chapters, tables, figures, and even individual paragraphs, and can handle paragraph section numbers up to ten levels deep. Because it can track all of these numbering schemes separately, it lets you generate a table of con-

tents, a table of figures, and even a table of tables within the same document.

The same trade-off between power and ease of use applies to *PageMaker*'s new indexing features. *PageMaker* allows up to three levels of indexing per item (one more than *Ventura Publisher* supports). You can cross-index items and automatically include a "see also" statement. As you generate index references, *PageMaker* adds them to a list of topics to which you refer for subsequent entries. This little miracle obviates the need for you to re-type every occurrence of an index entry with exactly the same spelling and syntax. Best of all is *PageMaker*'s Show Index command, a nifty feature that displays an editable interim list of each reference. You can correct spelling errors, edit index entries, add cross-references, and delete redundancies before generating the final index.

Although *Ventura Publisher* lacks the convenience of these features, its reference tools (as opposed to its index tools) are much more powerful. Specifically, it supports true cross-references (as opposed to the cross-indexes in *PageMaker*), let-

ting you directly embed forward or backward referrals in running text. This makes it possible to cross-reference figures in body copy and generate "continued" lines automatically. With *Ventura Publisher*, you can even create dictionary-style indexes in which the first and last items on the page are automatically inserted in the running header.

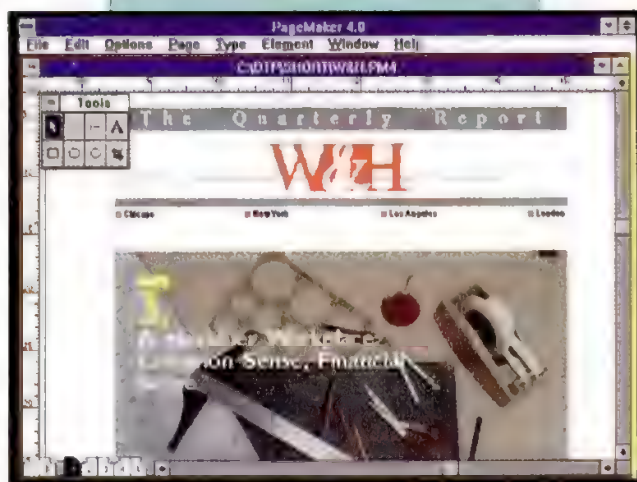
In the final analysis, *Ventura Publisher*'s advanced features are ideal for complex nested documents such as technical manuals, but *PageMaker*'s tools work just fine for most business publications, and their ease of use is a major asset. For those leaning towards a switch, Aldus has gone the extra mile to ease the transition, providing a new filter that lets you import *Ventura Publisher*'s .CHP files directly into *PageMaker*.

PUBLISHING BY THE BOOK

Truly long documents typically contain multiple chapters. *PageMaker*'s new Book command lets you dynamically link individual publication files into a large, multi-part document. Organizing the chapters of a book in this way allows you to surpass *PageMaker*'s file limit of 999 pages and create an opus of up to 9,999 pages.

The Book command is not quite as simple as its description makes it seem. Do not misunderstand: Adding file names to the book list and determining the way in which *PageMaker* will automatically assign page numbers when it compiles the document are both straightforward. Dialog box choices, for instance, let you force each chapter to begin on either a left-hand page or a right-hand page—even if that means inserting a blank page between the end of one chapter and the beginning of the next.

In practice, however, dealing with the complex numbering conventions of a multichapter book requires a little coordination. For example, each chapter maintains its own page-number options, determined in the Page Setup dialog box. This includes the ability to display folios as Arabic numerals, uppercase and lowercase Roman numerals, or uppercase and lowercase letters. Other options allow you to restart page numbering with any chapter or manually type a chapter prefix. In our long test document, we used these options to create page numbers for the introduction and table of



PageMaker 4.0 can now import 24-bit images. A full-color TIFF file (shown here) displayed in Super VGA mode has 256 colors on-screen, but you can also display the image in a 16-color dithered representation or gray it out to speed up screen redraws. The unique spacing for the Quarterly Report banner was achieved by using *PageMaker*'s new Force Justify alignment option in conjunction with custom letter and word spacing.

contents with lowercase Roman numerals, while using Arabic numerals in the actual chapters. (We restarted numbering at chapter 1 with the Page Setup dialog box.)

Keeping track of the options you have set in each individual chapter file can become difficult when you try to use compound folios that use the chapter number as a prefix to the page number (for example, page 1-5). Since you must manually insert all prefixes that will appear in the table of contents (TOC) in the Page Setup dialog box, changing the order of the chapters in the Book dialog box requires you to edit the prefix for each affected file individually. Furthermore, because the chapter prefix listed in the Page Setup dialog box is not dynamically linked to the Master Pages, you have to edit those as well. By contrast, Interleaf's *Interleaf Publisher*, which is designed especially for producing complex long documents, can renumber all folios, chapters, TOC entries, indexes and cross-references automatically, so changing the chapter order is simply a matter of dragging an icon to a new location on the desktop.

The great benefits of *PageMaker*'s Book command outweigh the real but minor annoyance that accompanies compound folios. For example, the book list lets you tap *PageMaker*'s ability to cross-

reference index topics between chapters. A copy of the book list must reside in each chapter, but luckily you do not have to keep recreating it. Instead, create a book list just once in any named chapter of your linked document. Then while still in that chapter, click on the Book command while holding down the Ctrl key. *PageMaker* will automatically update all of the chapters in the document with the new book list information.

IT'S ELEMENTAL

Desktop publishing of any kind and at any level is about tying various elements into an integrated design where pictures enhance text and words take on artistic attributes. *PageMaker*'s new Story Editor, Table Editor, Link functions, and import filters make it possible to manage—and even massage—the many disparate elements that constitute a single publication.

The Story Editor is a bare-bones word

processor that pops up when you triple-click on any text block in a *PageMaker* layout, (or, alternatively, when you select a text block and choose Edit Story from the top line menu). The Story Editor speeds up text alterations and formatting because it does not have to deal with the overhead of composing text on the fly. In

addition, the Story Editor window presents each article in one continuous stream of text, even though the copy may wrap around graphics or jump to noncontiguous columns. It is particularly useful for editing the contents of newsletters and magazines, which may contain multiple intertwined stories.

If you see the Story Editor purely as a word processor, you will benefit from its

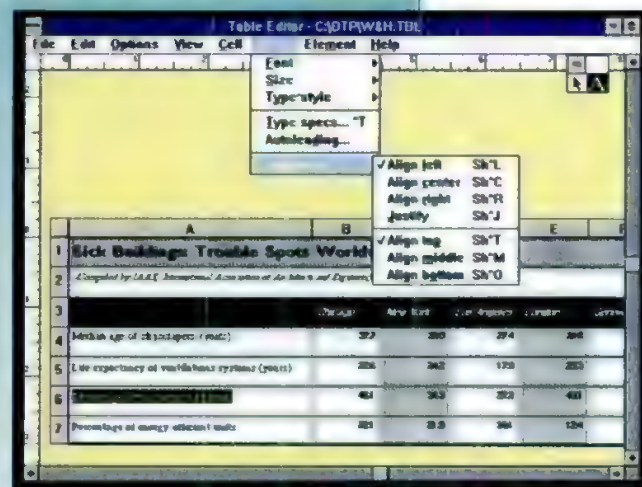
100,000-word spell-checker and the ability to choose any *Windows*-supported font, including a proportional one, for display. But power users will consider the text-editing capabilities of the Story Editor secondary to its ability to display, search for, and replace paragraph styles, type attributes, and non-printing characters (such as index tokens and tab stops). With these, you can combine operations to effect complicated textual and format revisions to an entire story in one swoop.

For example, if you search for something like "Aldus Prep^?", the Story Editor will find all occurrences of the

word—including misspellings—because the caret/question mark combination performs a fuzzy search. Replacing this with "Aldus PrePrint^;" not only corrects the spelling but instantaneously creates an index entry for every occurrence of that word (that's the meaning of the caret/semicolon combination). If you fiddle with the Attributes setting, you can even make sure that this text always appears in italics.

PageMaker requires you to open a separate Story Editor window for each text block (or story) in a publication. But you can keep a number of Story Editor views open simultaneously, managing the resulting screen clutter by iconizing the various windows. Do not confuse this capability with Microsoft's Multiple Document Interface. *PageMaker*'s ability to track multiple story threads is based upon proprietary technology, not MDI. The only way to open two *PageMaker* publications simultaneously is to run two separately installed copies of the program, which requires that you have RAM and disk space to burn.

Our testing revealed only two slight problems with the Story Editor. First, you must enter different key combinations to designate special or nonprinting characters (such as copyright symbols or soft hyphens), depending upon whether you are working in a dialog box or in the WYSIWYG (Layout) view. Keeping track of both styles mentally is confusing. Second, the Story Editor sometimes displays



PageMaker's bundled Table Editor lets you format tabular material almost effortlessly. You can group columns to accommodate large headers, and assign tints to cells, rows, or columns. In addition to *PageMaker*'s standard side-to-side alignment options, the Table Editor contains unique options for top-to-bottom alignment.

fonts and word spacing incorrectly. For example, the *Windows* system font for italicized Times Roman had the last letter of each word clipped from view and text with multiple tab stops refused to align properly. You can minimize these problems by using a scalable *Adobe Type Manager* typeface for the most accurate screen display, or by switching to a monospaced typeface, such as Courier, when working with tabular material. Though these discrepancies were maddening, they proved to be display problems only. Both the layout view and the printed document were always correct.

CARDS ON THE TABLE

In earlier versions of *PageMaker*, the tab ruler was the only way to align columns of text and numbers. For charts with multiple line entries, editing was a painful process that required realigning the tab stops every time you added copy. But now, *PageMaker*'s bundled Table Editor program makes the creation and editing of complex word charts child's play. With row and column addresses, the program looks like a spreadsheet, but because it is basically a word processor, it automatically expands cells for multiline entries, saving you hours of tedious work.

Just Ctrl-double-click on the table and *PageMaker* will launch the Table Editor with that associated data file, using a proprietary linking scheme (not based on Microsoft's OLE technology). Once there, the Table Editor's self-explanatory menus allow you assign type styles to the contents of a cell, using any *Windows* typeface. In addition to the standard side-to-side alignment options, you can indicate the vertical placement of text within a cell. And with a few mouse clicks, you can accommodate cross-column headlines by grouping cells, highlight columns or rows by adding gray tints, and separate the data with rules.

The Table Editor is easy to use, but it isn't flexible enough. For starters, although you can paste a table into a *PageMaker* document as either a .TBL or a .WMF file, you must always return to the Table Editor to make changes. The one exception to this rule is if you export your table as text only—but then you lose all your formatting and must deal once again with *PageMaker*'s tab alignments. The Table Editor does not support color of any kind. It

To save disk space and facilitate workgroup publishing, *PageMaker* can establish links to text and table files as well as to graphics. The minus sign (-) on the highlighted item indicates that the external file has been modified but that no automatic update was requested. You can view more-detailed information by clicking on the Link Info button; the Link Options button lets you change the link status so that it will be automatically updated when the linked source file changes.

supports only one math function (sum), and importing data from a *Lotus 1-2-3* or *Microsoft Excel* spreadsheet can be a trial. Since you cannot open a window into the spreadsheet to pick out the data you want, you must either use lots of named ranges in your original worksheets or enter cell addresses blindly.

Although the Table Editor has no trouble reading the data in external worksheets, formatting commands pose some problems for the import filter. For example, the utility will read *Lotus .WK1* files directly, but it treats the information only as text. It does not import the type-formatting attributes or any formulas. But any formatting attributes you apply within the Table Editor remain intact even if you update the information by reimporting the external spreadsheet. On the other hand, when you import *Excel* files, the Table Editor can retain type specifications, though it does not pick up information such as rules, tints, or pattern fills. But updates from the source *Excel* file will override the design decisions that you

have made within the Table Editor.

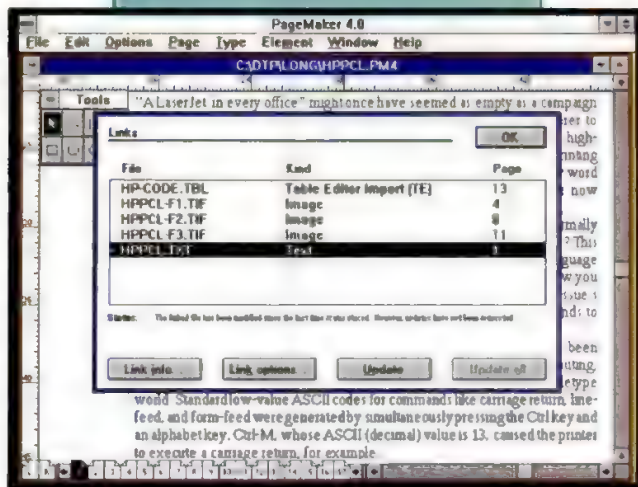
If you are an ambitious spreadsheet publisher who wants to take full advantage of *PageMaker*'s sophisticated design tools, you are better off bypassing the Table Editor and importing your spreadsheet data into *PageMaker* directly. Although *PageMaker* cannot read any formatting information from .WK1 files, you can get around this small limitation by embedding style tags in the worksheet directly; they will be applied when *PageMaker* imports the file. *PageMaker*'s smart import filter for *Excel* provides a more elegant solution. When you "Place" an *Excel* file in a *PageMaker* document, you transparently create a DDE link that can launch

Excel to update information, display all of *Excel*'s formatting attributes, or generate a graph from a named data range. This eats up a lot of memory, particularly when *Adobe Type Manager* is loaded: You should have at least 4MB of RAM in your machine if you want to be a DDE power user.

PageMaker is no slouch when it comes to importing word processing files or graphics, either. With Version 4.0, it can now understand *WordPerfect* stylesheets, and it correctly formats *Microsoft Word*'s table of contents, index, and footnote entries. In addition to its ability to import all important standard graphics file formats (EPS, HPGL, .PCX, TIFF, .WMF, and others), *PageMaker* lets you place Micrografx .DRW, .PIC, and *Charisma* files directly into your documents in their native format. Through DLLs (dynamic link libraries), *PageMaker* accesses Micrografx's proprietary display and printer drivers to generate the highest-quality representations of these images.

MAKING THE RIGHT CONNECTIONS

Since the beginning, *PageMaker* has conserved disk space and memory by using low-resolution representations of TIFF files for position, sizing and cropping purposes, while maintaining a link to the original high-resolution image. Version 4.0 extends this concept to give you control over links to any external file, regardless of whether it is in graphics, text, database, or spreadsheet format. The links can be set to update automatically or to alert you to the fact that the source document has been modified.



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Because *PageMaker* 4.0 uses *Windows* 3.0's network support wisely, links to external files work the same way on stand-alone or network installations. So it is possible to use linking as a bona fide workgroup publishing tool. Each contributor can update the document by revising the linked source files for which he or she is responsible. You can then "publish" the file by gathering the latest versions of the source files via *PageMaker*'s powerful link options.

Browsing the Link Info dialog box lets you quickly ascertain the status of each linked file. Shorthand codes alert you to such things as broken links (?), impending automatic updates (+), a modification to an external file that will not be routinely updated (-), and cases in which internal edits will be lost if the externally modified file is imported (!). This last alert message reveals the main shortcoming of *PageMaker*'s linking scheme. Any editing changes you have made to the text internally in order to accommodate the design—even little ones such as soft hyphens, in-line graphics, or kerning adjustments—are lost when you reimport the file from the external source.

In our testing (performed on a Compaq Deskpro 386/25e server, with a *NetWare* 3.1, Token-Ring network), the links between the *PageMaker* document and the source files—which were stored on various drives—worked flawlessly. True to Aldus's claims, installing and running *Page-Maker* in a multituser environment is fairly straightforward, though you should be prepared to edit the WIN.INI and ALDUS .INI files manually. In theory, only the two initialization files ALDUS.INI and ALDUSN.UDC must reside locally, but for optimized performance, Aldus suggests that you install each copy of *PageMaker* locally. You can still conserve disk space by leaving the large dictionaries and import/export filters on the server. Not only can they be shared between users, but other Aldus applications such as *PC Persuasion* can take advantage of them as well.

As long as we followed the rules, *PageMaker*, *Windows*, and *NetWare* worked well as a team. Multiple users could open copies of the *PageMaker* templates; print jobs were captured by the network and spooled to the shared Post-

Script printer. But we discovered that *PageMaker*'s implementation of file locking at the publication level needs improvement. *PageMaker* locks the publication (.PM4) files when they are in use. But if you attempt to open a file already in use, you do not get a polite message informing you that the file is unavailable: You get a disk-sharing violation alert. Though this is a harmless error that does not damage data, it may alarm an unsuspecting user. At the moment, the only way to avoid it is to prevent multiple users from updating the *PageMaker* publication itself; contributors can continue to update documents by editing the linked source files, however.

SPECIALTY TOOLS

The workgroup publishing features of *PageMaker* alone, though useful for a

wide range of users, do not reflect the state of the art. For that, you must look beyond page-oriented DTP programs such as *PageMaker* or even *Ventura Publisher* towards a compound document processor such as *IBM Interleaf Publisher*.

Interleaf Inc. designed *IBM Interleaf Publisher* to avoid the number-one problem that plagues most workgroup publishing projects—reconciling incompatible text and graphics layouts—by generating layouts and compos-

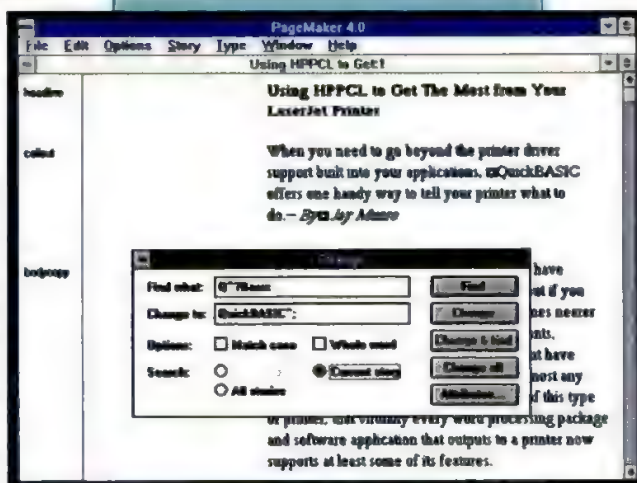
ing the text automatically. Each object in an *Interleaf* document has a property sheet that contains complex rules of logic that govern the automated layout process. This means, for example, that *Interleaf* will place a graphic according to the way in which the picture is anchored to the text and position preferences such as top-of-page, bottom-of-page, or straddle-column. That operation would have to be carried out manually in *PageMaker*.

Interleaf does not offer the typographic or design sophistication of *Page-Maker*, but it compensates by providing other unique features. When you compile a publication, you can instruct *Interleaf* to include or exclude paragraphs based on specific attributes. This makes it possible to generate versions of a document that differ in format and content simply by editing the property sheets. More impressively, it's possible to create powerful customized versions of the product for specialized tasks. *Interleaf* has already developed expert editors that know the appropriate format

for a publication and extensions that supply database front ends, including sort functions, to the basic publishing engine.

Ventura Publisher and *Interleaf* currently dominate database publishing (the formatted printing of large amounts of information from databases), but *Page-Maker* is poised for impressive gains in this area. Aldus is happy to admit that the extra clout comes courtesy of third-party programs. Two products already on the market, *PageAhead* from PageAhead Software Corp. (206-441-0340) and *Data-*

PageMaker is poised for impressive gains in the area of database publishing.



One of the most important benefits of *PageMaker*'s Story Editor is its ability to search and replace text within the layout. With the Change dialog box shown here, you can perform a fuzzy search that is not case-sensitive, letting you change all instances (even misspelled ones) of "Quickbasic" to "QuickBASIC." The addition of Ctrl-semicolon (^;) lets you index the word at the same time by adding a token to each instance of it.

Shaper from ElseWare Corp. (206-547-9623), give *PageMaker* powerful abilities to finesse and format database information.

The two programs are the same in their basic premises, although they vary in sophistication. In both cases, you create a dummy file that triggers a smart import filter when brought into *PageMaker* via the "Place" command. The filter massages the data, applies *PageMaker* paragraph styles, and can even import designated image files in order to automatically format directories, catalogs, or financial reports.

The more expensive of the programs, the \$795 *PageAhead*, is a standalone Windows product that allows you to see and manipulate your data in a spreadsheetlike interface. The program accesses a wide range of data from any source, directly reading *dBASE III* and *IV* files and connecting with minicomputer and mainframe databases through Oracle SQL client/server operations, or by QBE (Query-by-Example) calls. *DataShaper* is more modest and less expensive (\$249.95). It interprets only comma- or tab-delimited ASCII files, and it relies on *PageMaker*'s own tools to create the dummy document. *DataShaper* requires you to learn only a few standard database

GRAPHICS PAGEMAKER 4.0

references, but you must go through the extra step of exporting the *PageMaker* template as a .DSF (Data-Shaper Format) file before you can reimport it to invoke

DataShaper's formatting functions.

An even more promising development for specialty applications is Aldus Additions, a C-based command and query engine similar to Quark's Xtensions technology on the Macintosh. Expected to be

A THOUSAND FACES OF TYPE

by Luisa Simone

PageMaker 4.0's new type-specification features take some experimentation (and patience) to master, especially if you combine the formatting attributes for characters, words, and paragraphs. But once you understand how they work together, you can create some interesting effects and radically alter type's appearance.

To see what this means, look at the transformations we have achieved on a single representative specimen of text.

"Don't look back, something might be gaining on you."—Satchell Paige

The above sample is printed in 13-point Gill Sans at its default settings. Without altering the point size or the leading, you can easily change this passage so that it appears to be set in a different typeface: Simply adjust the width and tracking settings.

"Don't look back, something might be gaining on you."—Satchell Paige

To create a bolder, more impressive headline treatment, we used bold type and changed the width setting to 120 percent. We right-justified the copy, creating totally new line breaks. And to give the letters more breathing room—making the text more legible—we set the tracking to Loose.

"Don't look back, something might be gaining on you."—Satchell Paige

If you have too many words and not enough space, you can take the oppo-

site tack. In the third sample, we have set the width to 80 percent of the type's normal horizontal measure. The Normal tracking setting produced the right effect on character spacing (tight but not touching). If we simply stopped there, the words would be too close together for easy legibility, so we also adjusted the word spacing preferences in the Paragraph Specification dialog box. These specifications shaved an entire line from this block of text; you could use more-subtle settings on longer blocks of text and still save an appreciable amount of space.

"Don't look back, something might be gaining on you."

SATCHELL PAIGE

The final sample in our group combines two different paragraph formats. We have set the quotation's width at 110 percent. The type is centered; for total control over the word breaks, we used manual hyphenation. To highlight the attribution, we used a rule as part of the paragraph style and set the type in small caps with a superscript attribute. The ability to determine the size and position of superscripts and subscripts, as well as the ratio between initial caps and small caps, is a new feature in *PageMaker*.

These techniques can be applied to any scalable font, but the capabilities described here aren't magic. Type transformations performed by mathematically altering the character outlines can distort the balance of the characters: Notice how the lowercase *k* seems weak when expanded, and how condensing periods flattens them into ellipses. For this reason, the type-specification features are good to have, but type transformations are no substitute for true condensed fonts. ■



PageMaker, Version 4.0 for Windows
Aldus Corp., 411 1st Ave. South, Seattle, WA 98104-2871; 206-622-5500; upgrades, 800-243-3173.
List Price: \$795; upgrade from Version 3.x, \$150.
Requires: 286-based PC or better, 2MB RAM, 20MB hard disk space, DOS 3.1 or later, Microsoft Windows 3.0, mouse, EGA or VGA graphics adapter or better.
In Short: Although its competitors retain an edge for highly specialized publishing projects, *PageMaker* has the right mix of features and functions for the broadest base of users. In Version 4.0, its robust design capabilities are fortified with long-document and color-publishing functions that are relatively easy to use and highly suitable for most business purposes.

CIRCLE 686 ON READER SERVICE CARD

incorporated into the next version of *PageMaker* (which is due in 1992), Additions technology will allow user-defined scripts and specialized utilities written as DLLs (dynamic link libraries) to function as though they were internal *PageMaker* commands. Additions will also give external applications the ability to drive *PageMaker* via DDE links. Just imagine being able to create a *PageMaker* publication by remote control from within your *Excel* program!

DESIGN TALENTS

As important as *PageMaker*'s linking and indexing features are in the creation of long documents, its new typographic controls are equally significant. If you have correctly specified the paragraph formats, designing text-intensive documents can be as simple as autoflowing the text and instructing *PageMaker* to read the embedded style tags during file import. *PageMaker*'s abilities to force column and page breaks as part of a paragraph style, to use dictionary and algorithmic hyphenation in combination, to control widows and orphans, and to keep lines together all help avoid most awkward layout problems.

PageMaker's new paragraph rules and its support for in-line graphics (graphics that are linked to their associated text and flow with it) are also useful allies for creating attractive low-maintenance documents. For instance, we were able to format white text against a black background by forcing a wide paragraph rule to print behind reversed text. Although you can achieve the same look by placing a stationary black rectangle behind white text, you would have to move the rectangle manually every time the text reflowed. Because the paragraph rule is part of the paragraph style, it moves whenever you recompose the text.

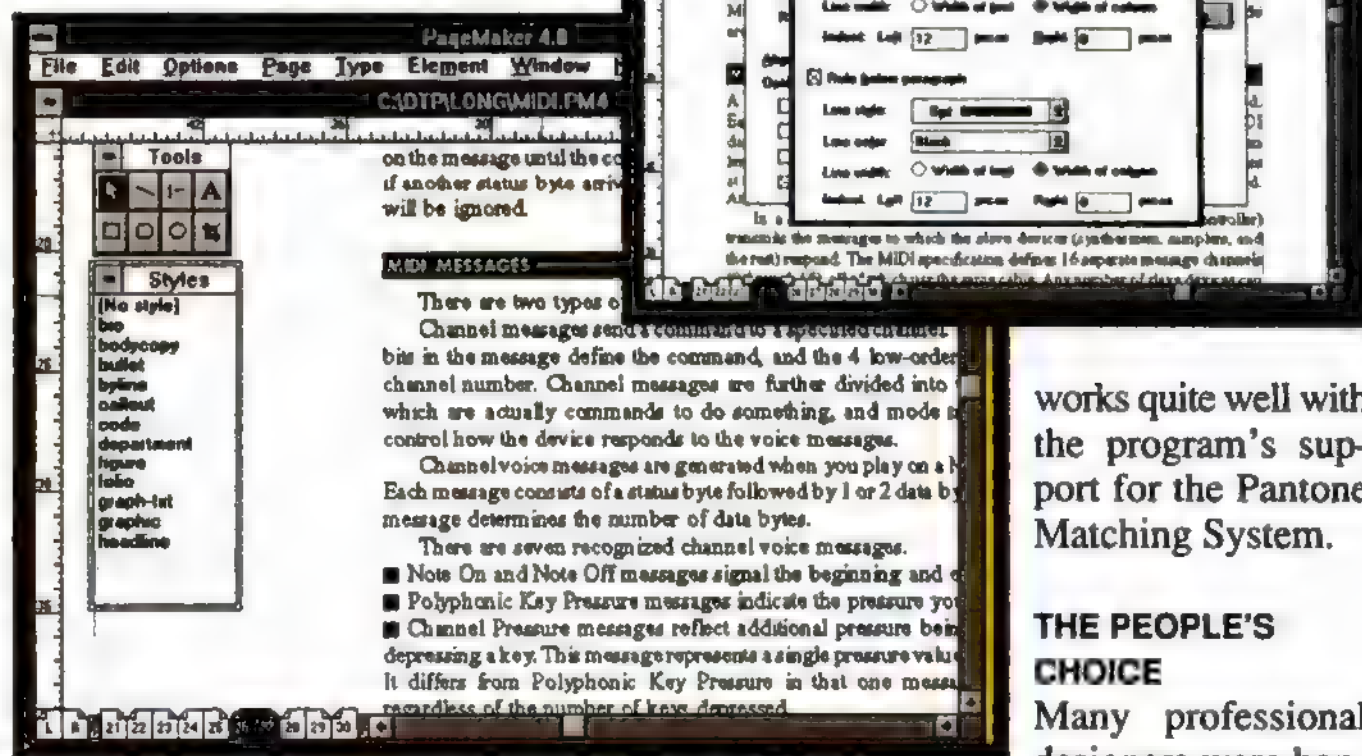
Regardless of the length of your document, *PageMaker* gives you plenty of tools to allow you to control the nuances of type design. Its character and paragraph formatting options let you create subtle differences in word density by setting the copy loose or tight. Settings for interword and intercharacter spacing, five levels of tracking (where the amount of space between letters and words is adjusted in relation to the size of the type), and a Set Width option (which condenses or expands type horizontally from 5 to 250 percent) can all help you determine the legibility of your type. (See the side-

bar "A Thousand Faces of Type.") These advanced text-handling tools are made possible by the use of scalable outline typefaces. *PageMaker* 4.0 comes bundled with a special version of *Adobe Type Manager* that includes Gill Sans and Times New Roman PS typefaces as well as Courier and Symbol typefaces: *PageMaker* can size type ranging from 4 to 650 points.

No matter how thorough you are, chances are that you will have to tweak a publication here and there with some of *PageMaker*'s manual tools. With Version 4.0, kerning can now be applied over a range of letters instead of just between letter pairs, and in finer increments of either $1/25$ or $1/100$ of an em space. Forcing better line breaks in a copy block is now as simple as entering a soft carriage return (Shift-Enter). And aligning text blocks across columns requires only that you set the custom vertical ruler to the same size leading as your type and snap text blocks to the grid. Unfortunately, the Type and Paragraph Specification dialog boxes are now up to three layers deep, making it somewhat difficult to

learn to use them. Also, *PageMaker* contains no preview boxes. You must exit to the document in order to see the new parameters take effect, so designing an original type style by trial and error can be painfully slow.

Most publications will continue to be in black and white, but for those who want to branch out into color publishing, *PageMaker* now has substantial color capabilities. You can specify any of 16.7 million colors for text or internal graphics (using RGB, CMYK, or HSL color models), and you can place 24-bit full-color scanned images, which can be displayed in dithered form on standard 16-color VGA systems, or can be turned off or grayed out for improved screen performance. Though it cannot generate four-color separations directly (see the sidebar "Separations Without Trial: Using *PageMaker* for Color Publishing"), *PageMaker* 4.0 can produce spot color overlays, complete with knockouts, for any number of named colors. This scheme



The reversed subhead and bulleted text in this document were created by manipulating *PageMaker*'s ability to add a rule to any paragraph style. Be prepared for a bug in the screen display: The rule sometimes disappears, as does the text. To force a screen redraw, zoom out and then back in. In addition to line weight, line style, and color, you can adjust the position of the rules in relation to the baseline and specify custom indents.

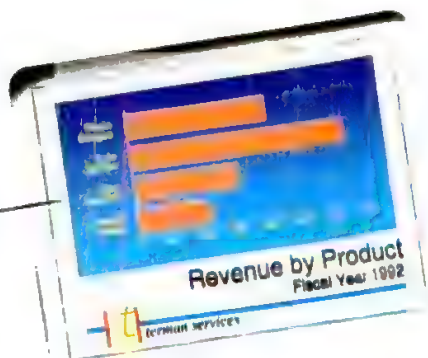
works quite well with the program's support for the Pantone Matching System.

THE PEOPLE'S CHOICE

Many professional designers were hop-

ing to see *PageMaker* 4.0 match the text-handling and design capabilities of *Quark Xpress* on the Macintosh. It is true that *Xpress* still comfortably exceeds *PageMaker* in raw precision; it can specify type sizes to within $1/100$ of a point (compared with *PageMaker*'s $1/10$ of a point) and it can adjust leading and kerning values to $1/1000$ of an em space, a much finer increment than *PageMaker*'s $1/100$ of an em space. The difference, however, is nothing more than a hedge against future hardware improvements. Today's type-

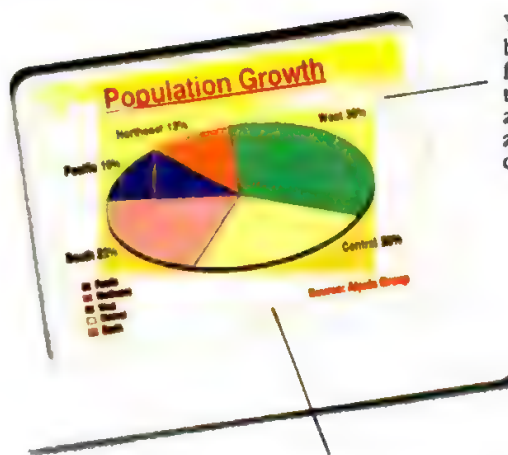
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CIRCLE 477 ON READER SERVICE CARD

SEPARATIONS WITHOUT TRIAL: Using PageMaker for Color Publishing

by Luisa Simone

PageMaker 4.0's improved color capability makes it easy to incorporate 24-bit images—in either TIFF or EPS format—into your documents. But getting those images off your computer and onto a printing press for high-quality, low-cost reproduction is not quite as simple. *PageMaker* can produce spot color overlays for numerous named colors, but it still cannot generate true four-color separations directly.

Color separation is essentially the conversion of the RGB (red, green, and blue) values used in computer graphics programs to the CMYK (cyan, magenta, yellow, and black) values required by commercial printing presses. This sounds straightforward, but in practice it is no easy task. RGB is an *additive* color model, in which colors are formed by combining different colors of light. While this is suited to monitors, which use light to generate hues directly, creating the same effect on paper—on which colors are produced by reflection through the inks—requires that you use a *subtractive* model.

Colors defined by percentages of red, green, and blue can be translated into colors represented by cyan, magenta, and yellow. In theory, you should be able to generate black, which has RGB values of 0,0,0, by printing a mixture of 100 percent cyan, 100 percent magenta, and 100 percent yellow. In practice, though, printing inks are neither as saturated nor as pure as RGB colors. The color combination of cyan, magenta, and yellow inks (called *process-black*) tends to look more like a muddy gray-brown than a pure black. Moreover, printing process-black requires 300 percent ink density (100 percent for each of the three components). No offset printing press can possibly lay down that much wet ink on paper, so dark shadows and solid blacks would be virtually unprintable using a CMY color model.

To get around this problem, printers add a fourth component consisting of pure black ink; separation packages have

algorithms for generating the right black component for each CMY color (a process called *undercolor removal* or *gray-component replacement*). But just what constitutes the right percentage of black and whether the parameters should be user-controllable are subjects of hot debate. Everyone is waiting for a device-independent color standard to emerge—promising candidates include the Color Portability mechanism proposed by EFI (Electronics for Imaging), Adobe's PostScript Level 2, and the PhotoYCC standard currently being developed by Kodak. Meanwhile, virtually all of the desktop separation products on the market today use proprietary algorithms to work their magic.

IN CAPABLE HANDS

If your service bureau is trustworthy, the easiest course of action is simply to print your publication to disk as a color PostScript file and let the service bureau worry about the separation. *PageMaker 4.0* aids this process by inserting OPI (Open Prepress Interface) comments into the PostScript file (these instructions describe the sizing, cropping, and positioning actions that should be applied to the scanned color images in your document). This allows the service bureau to incorporate external scans of the images into the final separations. Aldus admits that *PageMaker 4.0* on the PC does not totally comply with proper OPI usage; for one thing, it leaves its own internally generated low-resolution bitmap in the file. But its deviations are so few and so predictable that a savvy film bureau should be able to overcome them. Aldus claims, in fact, that Linotype-Hell (the company that makes Linotronic typesetters) has successfully generated separations using *PageMaker's* OPI comments.

You may be loath to relinquish control of your documents to a service bureau, however. If so, a desktop separation program can provide a suitable in-house solution. If you go this route,

be aware that color-separation programs require a considerable amount of knowledge and training to use effectively; you will have to spend some time experimenting to get good results.

It does not pay to be PC-centric in your search for a separation program. Because support for 24-bit color has long been integrated into the Macintosh operating system, the Macintosh platform has had a few years' head start on the PC when it comes to color-separation technology. And since most separation programs work from color PostScript printer files that contain all of the necessary text and image information, they are easily transported from PC to Macintosh.

In fact, this is the strategy supported by Aldus itself: *PrePrint*, Aldus's own color-separation program for *PageMaker*, is available for the Macintosh only. This \$495 program's abilities are basic: It gives you no control over dot shape, nor does it handle trapping (creating a slight overlap from lighter to darker colors to compensate for misalignments on the press). But this is a deliberate decision to shield novices from such confusing technical matters. Instead of asking you to designate the proper screen angles, *PrePrint* includes a database of Adobe's optimized screen tables, helping you avoid moiré patterns without having to become an expert on film.

Using desktop computers to produce full-color publications requires two major translation processes. First, the continuous-tone colors of a photograph are captured by the scanner as digitized RGB data. The RGB data is then converted to its CMY equivalents, and a black component is generated to compensate for ink contamination.

The ultimate quality of the printed TIFF or EPS image is heavily determined by software. Scanner control software, for example, includes algorithms for edge enhancement, calibration, and gamma correction. Color-separation programs let users control undercolor removal and use screen angles that have been optimized for final output on the high-resolution image-setter.

Another vendor of Macintosh separation solutions is PrePress Technologies (619-931-2695), which addresses different markets with different products. Its \$295 *Spectra Seps PM* is aimed at novices, offering simple choices for fast, easy separations, while its \$5,000 *Spectra Print Pro 2.0* is a programmable high-level separation package that gives expert users precise control. If you are a stickler for color accuracy, you might want to wait for *Cachet* from EFI (415-742-3400), which uses EFI's device-independent color model. Its advantages include sophisticated tools like the Gamut Alarm, which alerts you if you specify colors in the RGB color space that cannot be matched with CMYK inks.

Don't be too quick to write off PC-based programs, however. For the most part, they are more production-oriented than their Macintosh counterparts, addressing the nitty-gritty problems of film separations, such as trapping. *Publisher's Prism* from InSight Systems (703-938-0250), available in both DOS and Windows versions, is distinguished by its sophisticated, easy-to-understand undercolor removal controls: You simply indicate the threshold at which undercolor removal will begin and the rate at which it will occur. And *Hijaak ColorSep* from Inset Systems (800-828-8088), which was originally marketed by

Ozette Technologies as *ColorSep PC*, is firmly grounded in real-world production practices. You can generate densitometer readings from a sample output file, and once you enter the readings into the system, the program will automatically adjust for dot gain. Each program costs \$695.

WHERE IT STOPS

PageMaker's reliance on external third-party programs may ultimately handicap it in the color-publishing arena. Two major competitors on the PC promise to offer built-in color-separation capabilities, with potentially better quality than you can get by postprocessing color PostScript files.

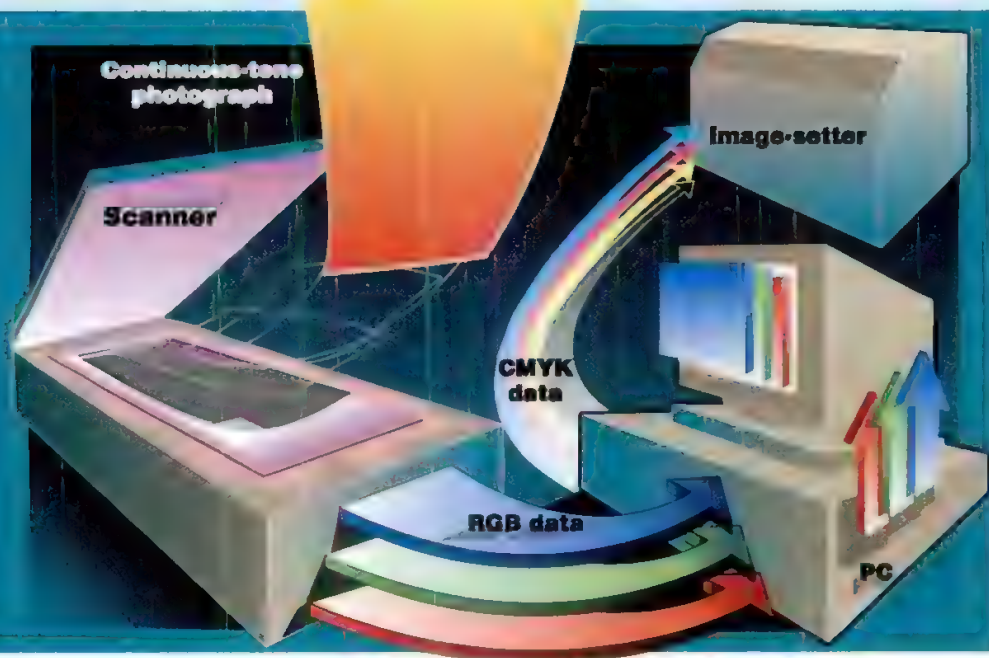
Quark Xpress on the Macintosh already directly generates four-color separations for internal elements such as text and rules. It can also separate any embedded graphics that contain CMYK information, such as Adobe-conforming EPS files from programs such as *Adobe Illustrator*. And *Spectra Seps QX*, a \$495 Quark XTensions utility from PrePress Technologies, separates RGB images on the fly from within *XPress*. Expect to see similar capabilities in the Windows version of *XPress*, due by the end of this year.

Meanwhile, Xerox Corp. has announced a joint venture with PrePress Technologies that will produce four professional-level

color publishing modules for an upcoming Windows version of *Ventura Publisher*. The utilities will be implemented in the form of dynamic link libraries (DLLs) and will appear on *Ventura's* menu just as if they were internal tools. In addition to *Ventura Scan* (which will support a range of high-end color scanners) and *Ventura PhotoTouch* (which will offer complete image editing and enhancement tools), PrePress Technologies will supply two color-separation packages: *Ventura Separator*, a basic package designed to get acceptable results with minimum adjustment, and *Ventura ColorPro*, a professional-level package that lets you control just about every separation parameter.

Early demonstrations of *Ventura Publisher's* color-publishing technology are impressive. Processing instructions can be applied to a publication globally or to individual images within a document. And many of the processing parameters created in *Ventura ColorPro* are downwardly portable to *Ventura Separator*, so experts at a service bureau can adjust the settings for the business users who generate film with *Ventura Separator*.

Aldus is unlikely to duplicate these internal color-separation capabilities within *PageMaker*. Unlike its rivals, *PageMaker 4.0* does not store the RGB values of high-resolution color images internally. But *PageMaker 4.01* on the Macintosh, with new limited support for the Desktop Color Separation specification (DCS) originally developed by Quark, hints of future capabilities. DCS is a modified, pre-separated form of EPS that allows four-color separations to be passed from high-end color image-editing programs such as *Adobe PhotoShop* through your desktop publishing program to the final output device entirely in electronic form. Between DCS and DDE links to external programs via *Aldus Additions*, *PageMaker* should be able to compete effectively in the four-color arena. ■





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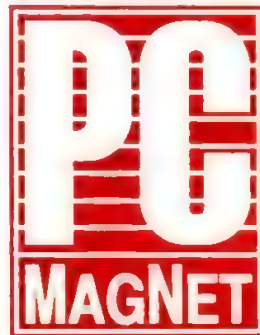
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setters top out at 2,540 dots per inch; in any case, the human eye cannot resolve the microscopic difference between 0.00013 inches ($1/100$ of a point) and 0.0013 inches ($1/10$ of a point).

Xpress does have an advantage over *PageMaker* in its ability to manipulate text and graphics with greater precision and flexibility. It lets you position objects more exactly, using x,y-coordinates or a host of alignment options. Achieving the same level of accuracy with *PageMaker* would require you to zoom to 200 or 400 percent magnification and align the elements manually by snapping them to the ruler guides. *XPress* also can generate drop caps and group objects, and it freely rotates both text and graphics by $1/10$ -degree increments, whereas *PageMaker* rotates only text (not graphics), and only at a 90-degree angle.

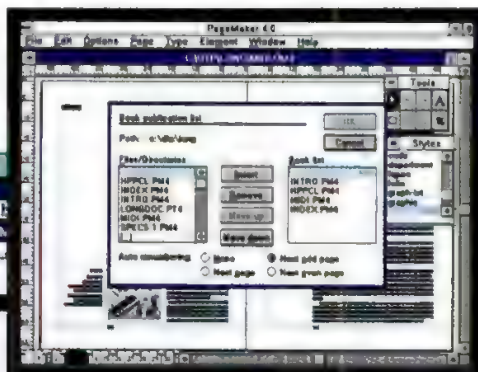
Quark Xpress for Windows is scheduled for release in late 1991. Like its Macintosh sibling, it is aimed at a market of professional designers, not business users. Many of *XPress*'s unique features become necessities only when you work with lots of design elements that must move together as a group, or that rely on nuances of positioning for their effect. *PageMaker*'s approach, admit-

PAGEMAKER 4.0

tedly rigid, forces you to move objects manually and apply a limited number of special effects from simple menus, but it remains instantly understandable to lay publishers and provides more than enough accuracy for ordinary design needs.

THE LAST WORD

Other programs on the market can produce specialized publications—such as database-derived directories or compound technical manuals—more efficiently than *PageMaker*. But most designers and business users are generalists, not specialists. For those who must produce a wide range of documents, from single-page memos, newsletters, and full-fledged business proposals to complete books, *PageMaker* provides a comprehensive toolset. Its new long-document features and more-sophisticated formatting options are more than capable of executing most business and professional design projects. And its new import filters (provided by third-party de-



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ORIENTATION AND PRINT DIRECTION	
COLOR POSITIONING	
PRINTABLE AREAS	
UNITS AND FILE	
SORT FONTS	
MISC	

With *PageMaker*'s new Book features, you can begin each chapter in a book on a right-hand page and restart page numbering as indicated in the Page Setup dialog box; you can easily create a complex table of contents from these complex page numbers. Note how the introduction is on page iii (Roman numerals), while the actual chapter starts on page 1 (Arabic numerals).

velopers as well as Aldus itself) interpret a wider variety of file formats more intelligently than any of its competitors. For the business user, whose word processing and spreadsheet files

have so much value, and whose needs are ever-expanding, this fact alone makes *PageMaker* the best choice.

A DTP expert once said that a beginner need know only one command in *PageMaker*—Place—in order to produce a document. That this is still true of *PageMaker* 4.0 is a testament to the enduring elegance of this product.

Luisa Simone is a contributing editor of PC Magazine.

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<i>Modes</i>	Supports EGA	None
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CIRCLE 316 ON READER SERVICE CARD

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Technology that works for life.

by
Barry Simon

Lab Notes

In the first part of this article, I presented an overview of the *logical structure* of a disk. I discussed the relationships between the sectors magnetically laid down during low-level formatting and the clusters into which DOS groups them. We saw that in the first sector of a partitionable hard disk, FDISK creates a partition table that directs DOS to the bootable partition—normally Drive C:—whose boot record contains a short segment of code that initiates the process of bringing up the operating system.

Immediately after the boot record come the file allocation tables (FAT) whose 12- or 16-bit entries (12-bit for versions of DOS prior to 3.0, diskettes, and small hard disks) can keep track of 2^{16} items. Each entry in the FAT, except the first two (which contain the media descriptor byte followed by FFs), either carries a special code (for example, bad cluster or end of file) or forms part of a numeric chain. Each link of this chain points to the *next* cluster in the data area used by a given file.

Following the FAT comes the root directory, which contains (in addition to the filename and other related information), the first cluster number and the size of each file. The partition table, the boot record, the FAT, and the root directory together comprise the system area of the disk. The remaining clusters on the disk or disk partition hold the data that constitutes the various stored files.

Finally, by way of review, in Part 1 I presented two demonstration programs, READBOOT.EXE and PCMFAT.EXE, whose executable and source files can be downloaded from PC MagNet. The sidebar “READBOOT and PCMFAT: Programming Considerations” discusses the technical aspects of their design and operation.

The Norton Utilities, *PC Tools*, and *The Mace Utilities* are the three best-known utility packages designed to help you cope with disk disasters, and every prudent disk user should have at least

What You Can Do to Overcome Disk Disasters, Part 2

■ Understanding how today's sophisticated file recovery tools accomplish their magic is the key to putting them to their most productive use.

one of them on hand at all times. Before examining how these third-party programs work, however, let's take a look at the tools DOS itself provides for detecting and rectifying disk problems.

DOs AND DON'Ts WITH DOS

If you read its description in your DOS manual, RECOVER.COM seems like the perfect tool for saving files from a disk that has developed a bad sector. In fact, for most problems, the only use for this program is to convince you that, bad as things are, they can actually get worse!

Entering the command

```
RECOVER filename
```

can indeed help you cope with a file whose disk space has gone physically bad—although something like *Norton's Disk Doctor* is a much better choice. However, entering

```
RECOVER
```

with no parameters on a hard disk is an accident waiting to happen. You will receive

the message: “The entire drive will be reconstructed, directory structures will be destroyed. Are you sure (Y/N)?” If you answer yes, and if you “Press any key to begin recovery of the file(s) on drive C:”, RECOVER will turn your subdirectories into files and prevent you from accessing them! RECOVER is a holdover from the days of diskettes-only operation. Some of the disk tool sets have the ability to help you “recover from RECOVER,” but your safest move is to delete this command from your DOS directory!

More useful, by contrast, is CHKDSK (short for *check-disk*), which has long been one of the more sophisticated programs included with DOS. Its name is perhaps slightly misleading, however, for two reasons. First, CHKDSK checks only the logical structure of a disk; it makes no tests of the physical (surface) integrity of the disk. Programs such as *Norton's Disk Doctor*, *Mace's Emergency Room*, and *PC Tools' Diskfix* can check both aspects. Second, CHKDSK is for disk repair as well as disk checking, and it is here that you must be particularly careful.

The full syntax for CHKDSK is

```
CHKDSK [d:] [filespec] [/f]
```

If no *d:* parameter is supplied, the program checks the current drive. The *file-spec* option activates a special mode that, in addition to checking the disk, checks whether the sectors of one or more designated files are contiguous. We can ignore that special use here. The */f* parameter is what turns on the disk fixing.

There is one very important rule to re-

READBOOT AND PCMFAT: Programming Considerations

by Barry Simon

Two sample programs, READBOOT.EXE and PCMFAT.EXE, were presented in Part 1 of this article (*PC Magazine*, September 10, 1991). READBOOT.EXE reads the boot sector of the default disk (or of another drive if a letter is supplied on the command line). PCMFAT.EXE takes the name of a file in the current directory and reports which clusters it occupies.

Both executable files and their commented source code can be downloaded from PC MagNet. However, there are some programming considerations associated with the use of low-level disk information that I'd like to relate.

READBOOT cannot use the standard DOS calls to read or write files (services 3Fh and 40h of interrupt 21h), because the boot sector isn't a file. Using the low-level interrupt 13h BIOS calls will get you worrying about heads and cylinders and won't handle partitions that don't start at the beginning of the disk without a lot of calculation. Thus, for both programs, I decided to use DOS interrupt 25h to read (if they were going to write, they'd use 26h).

One important warning needs to be given about these interrupts: For backward compatibility, they pass error information back in the flags register and leave the original flags on the stack. Their failure to leave the stack in its original state—unique among DOS BIOS interrupts—complicates calling them from a high-level language. My original attempt to use Turbo Pascal's built-in interrupt-calling procedure INT caused a crash because of

this stack problem. Consequently, I used Turbo's built-in miniassembler—and for this reason these programs require Turbo Pascal 6.0 if you want to modify and compile the source code yourself.

In order to handle disks larger than 32MB, these interrupts changed drastically with the introduction of DOS 4.0. In all versions of DOS prior to 4.0, the CX register held the number of sectors to read and DS:BX pointed toward a buffer for holding the sectors that were read. That remains true for DOS 4.0 and 5.0 if and only if CX is different from FFFFh. If CX is FFFFh, however, then DS:BX points instead toward an extended parameter table that has room for the larger starting sector numbers that partitions larger than 32MB can have. If you try an interrupt 25h/26h call on a disk larger than 32MB and you don't use the extended call, it will return with an error. So both programs use different code depending on DOS version.

There is another difference between DOS versions that you should be aware of. My first draft of READBOOT ran fine on my machine but crashed on an editor's machine. The problem was the DOS version. Prior to DOS 4.0, interrupt 25h trashed all the registers; 4.0 and later is kinder. So, to be safe for use with an early version of DOS, you'd better check that you have saved and restored registers properly. And you may have to understand something about how your high-level language processes these commands. Specifically as regards the sample code, it

is critical that BP be restored before the `mov ErrorOut, ax` command; ErrorOut is a local variable and its segment is saved in BP.

Beyond these issues, two aspects of PCMFAT are noteworthy. The program needs to find the starting cluster of a file, and this information is stored in the directory entry. To avoid following the directory chain using interrupt 25h, what you want is a call that will give access to the full directory entry. I consulted several DOS gurus and was told that the only way to go was to use undocumented calls/information. Indeed, I was even told that the method I wound up using was undocumented—when, in fact, it is documented!

If you use service 11h of interrupt 21h, then 33 bytes are placed in the Disk Transfer Area (DTA) you set with service 1Ah. The last 32 bytes are a copy of the directory entry for the file, and at offset 26 among them is the word that is the starting cluster. The *DOS Technical Reference* plainly states that "the next 32 bytes contain the matching directory entry." The book writers must not have noticed this, however, as several standard references refer to the bytes past the filename as "reserved."

A final point about PCMFAT concerns its handling of 12-bit FAT entries. It's a pain and a half to have to deal with three-nibble FATs because sectors don't contain a whole number of three-nibble pieces, and because some FAT entries span sectors! That's why PCMFAT reads in three sectors of the FAT at a time. Even so, these low-level calls require some care on the programmer's part. ■

member whenever you use the /f switch. Never run CHKDSK /f unless you have first run CHKDSK *without* /f and are *sure* you really want CHKDSK to fix the problem that it finds. This is so important, let me repeat it: Never even consider running CHKDSK /f without first running that command without /f and without knowing exactly what you are doing.

The reason for all this caution is that although CHKDSK is a great *diagnostic*

tool, its approach to *fixing* things follows the philosophy that the best treatment for an injured limb is to amputate it to save the patient. We'll later see which problems you should consider letting CHKDSK correct if you haven't got one of the "Big Three" utility sets.

There is another important DOS tool that is useful if your problem is with a diskette rather than a hard disk, and that is DISKCOPY. Anytime you have a disk-

ette with serious problems, use DISKCOPY to make a copy and try the corrections on that copy.

To these traditional DOS tools, DOS 5.0 has added MIRROR (a utility developed by Central Point Software, the maker of *PC Tools*), an UNDELETE program (a facility that first brought Peter Norton to widespread public notice) and an UNFORMAT command (which made Paul Mace famous). To understand how these

Lab Notes

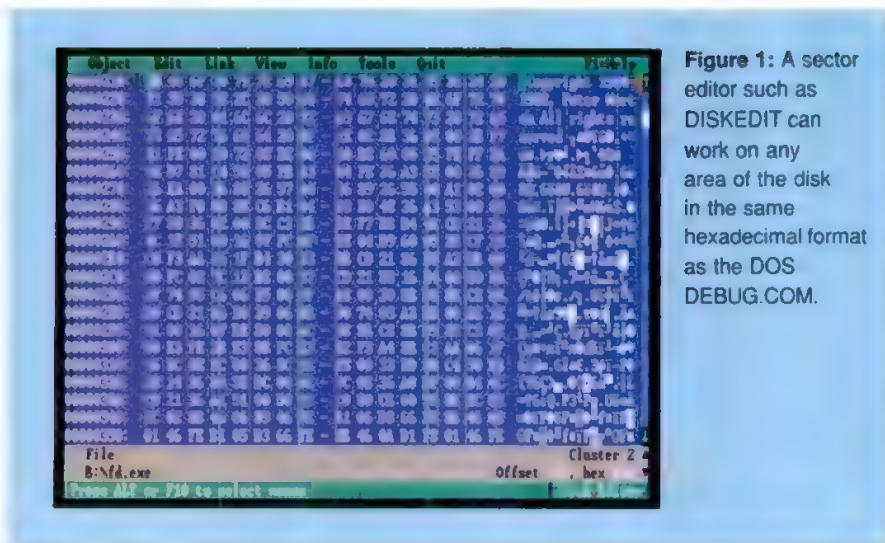


Figure 1: A sector editor such as DISKEDIT can work on any area of the disk in the same hexadecimal format as the DOS DEBUG.COM.

commands work, we should next turn our attention to the three major disk-recovery programs: *Norton*, *Mace*, and *PC Tools*.

UTILITY PROGRAM OVERVIEW

In recent versions all three of these utility sets come with programs you can run either manually or automatically (through your AUTOEXEC.BAT file) that back up the boot record, the FAT, and the root directory information in a separate file. *Norton 5.0* calls this program IMAGE (4.5 called it FRECOVER), *Mace* calls it RXBAK, and *PC Tools 6.0* calls it MIRROR. This backup copy of the system area is not always necessary; however, it is always desirable when it comes to making a successful recovery from the errors of nature and those of man that befall hard disk operations.

To understand the part these utility-generated insurance copies of the system area play, consider the process of recovery from the most common disk emergency of them all: the inadvertent erasure of a valuable file.

The first thing to realize about undeleting is that when DOS "deletes" a file, the data in the clusters that constitute that file is not removed or overwritten. DOS, in fact, takes only two actions. First, it changes the initial letter of the filename to the IBM-ASCII character 229 (the lowercase Greek sigma). Second, all the FAT entries that designate the clusters used by the file are replaced with zeros. This makes those clusters available for storing another file, but only at the point that they are actually used is the data

from the "erased" file overwritten.

Thus, if you erase a file in error and discover your mistake quickly, there is every hope of recovery using any one of the undelete programs included with the Big Three (and with DOS 5.0). Unerase programs rely on the fact that, since the only change in the directory table entry for the file is to the first letter of the filename, both the file size and the pointer to the first cluster of data remain in place. If the size of the deleted file is less than one cluster, total recovery of the file is assured—assuming, of course, that you haven't subsequently saved a file that might have reused that cluster. The undelete program simply prompts you to resupply the first letter.

Full recovery of multicluster files is also likely if a utility-generated backup of the FAT information is available.

The unerase utilities can use it to rebuild the entire cluster chain of a fragmented file without any effort on your part. While erasure zeros the original FAT entries, it does not affect the independently generated copy. This is far safer than relying on the second copy of the FAT that DOS maintains: If a problem arises because DOS wrote nonsense to the FAT in response to a bug in a program, it is likely to write the same nonsense to both copies it keeps!

When there isn't an independently created copy of the system area information, the algorithm that most file recovery programs use is less certain of success. It generally relies on the supposition that the relevant clusters in the file area are

contiguous. That's one advantage of defragmenting your disk often. In any event, the more-sophisticated recovery programs provide both automatic (best guess) and manual procedures that allow reconstruction of a file, cluster by cluster. The latter won't help you with binary files, of course; these aren't humanly readable. But with text files, as one of the utilities notes, if one cluster ends with "frag" and another, elsewhere on the disk, begins with "mented" you can be tolerably sure that these two clusters belong together.

FORMAT AND UNDOING FORMAT

With the magic explained, unerase may seem a little less wonderful, but it's no less useful for that. Even more extraordinary is the ability to recover from accidentally reformatting a hard disk.

To understand how the Big Three (and DOS 5.0) can save you from the consequences of an accidental FORMAT command, it pays to understand exactly what formatting a hard disk does. Except for certain maverick versions of DOS (from Compaq, AT&T, and Burroughs), FORMAT does not modify the data area of your disk at all! Instead, it changes only the FAT and the root directory. The FAT is changed so that no cluster is assigned and the root directory is cleared out. If that sounds a bit like what is involved in ordinary file deletion, it's meant to.

Full recovery from an unintended FORMAT does rely on your running *Norton's* IMAGE, *Mace's* RXBAK, or *PC Tools' MIRROR* (which Microsoft licensed from Central Point Software and included with DOS 5.0). These utilities save the current state of your FAT and the root directory to disk. Since these two items are the only ones FORMAT changes, however, restoration of the disk to the state it was in when you last ran the MIRROR-type program is easy.

Even if you've never run a MIRROR-type program, some recovery from a reformat is possible. Unfortunately, recovery of the root directory is not. But subdirectories are clusters on-disk that begin with a period followed by ten spaces and, at offset 32, have two periods followed by nine spaces. That signature will help a utility program find subdirectories. Thereafter, you may be able to use an unerase procedure to recover something—but probably not very much. The moral: Running an IMAGE-type program regularly promotes very good use of disk space.

Lab Notes

USING SECTOR EDITORS

Every one of the three major disk recovery programs have thoroughly automated their procedures for handling major problems. *Norton* calls the DISK DOCTOR, *Mace* rings up the EMERGENCY ROOM, and *PC Tools* mobilizes DISKFIX. In addition, all three utility sets provide the tool of last resort: a manual sector-editing program.

Using a hex or sector editor seems so techie and so low-level that many users are frightened by the prospect. There is no reason to be; while these are indeed powerful programs that have the potential for great damage, the utility manufacturers have made their operation simpler and safer than it once was. Used intelligently, sector editors are not only useful but sometimes essential.

I'll use the DISKEDIT program from *Norton 5.0* as a descriptive example. *PC Tools* has a sector editor called from the "View/Edit Disk" option on the Disk menu in PCSHELL. *Mace* invokes the MUSE editor, while *Norton 4.5* (and earlier) provides for sector editing as part of the NU program. Although specific features in the various sets differ, the basic functionality is similar.

DISKEDIT lets you specify what you want to edit in a whole variety of ways. You can pick as your "object" a directory, file, cluster (by number), sector (by number in a partition or by number on a physical drive), partition table, boot sector, or either copy of the FAT. You can also choose to view it in Hex, Text, Directory, FAT, Partition Table, or Boot Record Format. Normally you'll use Hex or Directory format, but you won't hurt anything if you simply flip through the various options and see what each produces.

Three elements make a sector editor different from a file editor such as *Brief* or from your word processor's ASCII mode. First, with sector editors, you can change only individual bytes. In other words, you can't simply delete a byte and have everything else in the file automatically move up. Since both executable files and other binary files often depend critically on specific byte locations, this is an important safety feature. Second, a sector editor gives you direct access to areas (for example, directories) that a file editor cannot load and to executable files

that a file editor had best not load.

The third difference, obvious in Figure 1, is the selectable hex presentation mode that sector editors provide. This presentation mode is borrowed from DEBUG's display command. It puts an address on the extreme left, followed by 16 bytes per line and an ASCII representation of these bytes at the right side of the screen. You can edit either the hex or the ASCII side.

What are such editors good for? First, they make patching files easier—as when you read about a patch to COMMAND.COM you'd like to make, or when you get a patch from a software vendor. Although these often come with explicit DEBUG directions, you can see a bigger picture with a sector editor. You can also search for messages you don't like and edit them. And if you are brave, you can experiment with other changes. You may, for example, be tired of the fact that, by

Used intelligently,
sector editors are not
only useful but
sometimes essential.

default, *Microsoft Windows*' Notepad looks at only *.TXT files. You can fix this by searching NOTEPAD.EXE for TXT and replacing *.TXT with *.* followed by two spaces. (I can confirm that this patch works in *Windows 3.0*.)

A couple of cautions are in order: First, save the original file if you are fooling with an executable and work only on a copy. Second, before running a patched executable, save any work you have going on in TSRs or in other partitions of a task switcher/multitasker. And finally, be aware that some programs do Cyclical Redundancy Checks (CRCs) on themselves and will not let you patch them.

The other major use for hex editors is for low-level disk repair when the DISKFIX (*PC Tools*), DISK DOCTOR (*Norton*), or EMERGENCY ROOM (*Mace*) utility programs (or others like them) fail. After one disk disaster, for example, I found that the only way I could rid myself of a spurious entry in one of my subdirectories was to use a sector editor to replace

the first character in its name with the ASCII character 229 that denotes an erased entry.

LOST CLUSTERS

While accidental deletion or unintended reformatting are human errors, there are other problems that powerful disk utilities can solve. By far the most common is a relatively harmless one called orphaned or lost clusters. A typical message for this appears any time you run CHKDSK without the /f:

```
Errors found, F parameter not
specified
Corrections will not be written to
disk
72 lost allocation units found in
1 chains.
Convert lost chains to files
(Y/N)?
```

The last line of this message is misleading; since the /f parameter was not used, no corrections will be written to disk no matter which way you answer! The best solution is to answer N and then run EMERGENCY ROOM (*Mace*), DISKFIX (*PC Tools*), or DISK DOCTOR (*Norton*) and see whether these utilities can set things right (they usually can). Only as a last resort should you give up and convert the lost clusters into files, for you'll then have to reassemble them manually (if they're readable).

Lacking one of the Big Three utility kits, however, the proper response to a lost cluster message, assuming there are no other problems and not too many chains (fewer than 30 or so), is to run CHKDSK /f. Then you'll get the message

```
72 lost allocation units found in
1 chains.
Convert lost chains to files
(Y/N)?
```

Now the shoe is on the other foot: No matter what you answer to this question, CHKDSK will repair the disk! If you answer N, then the FAT entries for the clusters in question are marked as unused—as if you'd deleted them. If you answer Y, then CHKDSK creates files and assigns them to the chains. It names the files FILE0000.CHK, FILE0001.CHK, and so on, and it puts them in your root directory. If you already have files of those names, DOS uses the next free numbers.

Lab Notes

Orphan clusters are the flotsam and jetsam of fileland. They are typically produced when a program doesn't properly close a temporary file because of a crash or when you turn off the machine without exiting the program. Being the cautious type, I always answer Yes to the convert question, look over the files—and then erase them. Except when I've had a major disk problem, I have never found anything useful or worrisome in these files. I have a friend who always answers No and saves time. He's right, but I remain cautious and answer Yes.

CROSS-LINKED FILES

The second most common problem is cross-linked files. The message from CHKDSK reads:

```
C:\FIRSTNAM.EXT
  Is cross linked on cluster 5
C:\SECONDNM.EXT
  Is cross linked on cluster 5
```

where, of course, the filenames and unit numbers will vary. What happens here is that as CHKDSK runs through the chains, it finds that a cluster (known as an "allocation unit" in DOS 5.x) is assigned to more than one file. Clearly the FAT is fouled up. When this happens, neither file is usable until it is unlinked.

In this case running CHKDSK /f won't hurt—but it won't help either. CHKDSK doesn't take any action! What you should do depends on the files involved. If both files are executables or if you have good backups, the best policy is to just erase both cross-linked files and copy over from the originals or backups. Otherwise, copy both files to a new directory or (better) diskette. Then erase the original cross-linked files. If you've been running an RXBAK-type program, you might consider trying to unerase the files, just in case they were not linked in the old FAT. Alternatively, after making the copies, run the same automated disk repair utilities you would use for orphaned clusters.

After "recovery," one or both of the copied files will have incorrect material in it. If the files are text files, you can load them into an editor and see how bad the situation is, correct them, and save. If they are spreadsheet or word processor files, the new versions of *Mace*, *PC Tools*,

and *Norton* all provide a variety of "viewers" that let you see recovered clusters in their native formats. Or you can try to read them into the host program without anything else running so that you won't lose anything if your load attempt crashes the host program. (There is no excuse for such behavior, but, alas, a corrupted data file can have that effect on some programs.)

Cross-linking is a serious matter, and if it happens often you should consider the possibility of a severe hardware problem, such as a disk controller going bad.

SIZE ALLOCATION ERRORS

Another frequent problem that CHKDSK will report is a size allocation error. Here is a typical report:

```
Errors found, F parameter not
specified
Corrections will not be written to
disk
C:\filename.ext
Allocation error, size adjusted
```

As the first lines indicate, the size is not adjusted no matter what CHKDSK goes on to say! This is a case where you need to tread very carefully before running CHKDSK /f. What the message indicates is that the size of the file as reported in the directory is incompatible with the number of clusters assigned to the file.

For example, if your disk has 4K clusters and three clusters are assigned to it, the size of the file must be between 8,193 bytes and 12,288 bytes (8K + 1 and 12K). Any other size in the directory listing will trigger this error.

Again, the automatic disk repair utility programs should be your first resort. Automatically passing to CHKDSK /f may not be the correct approach at all. CHKDSK assumes that the FAT is correct and the directory entry is wrong, so it adjusts the directory file size to the maximum allowed by the disk allocation (12,228, in the example above). But it may be the allocation that has been fouled up. If you get a size allocation error, run DIR and see what size is given. If that size seems right, do not run CHKDSK /f. If nothing else works, try erasing the file and then unerasing it.

A rarer but similar error is

```
Has invalid cluster, file
truncated
```

in DOS 4.x and

```
Has invalid allocation unit, file
truncated
```

in DOS 5.0. This says that the pointer to the next cluster is a number that doesn't correspond to any cluster. Again, CHKDSK /f may be the wrong thing to do. Especially if this message is accompanied by a lost cluster message, you should consider erasing and undeleting if your disk recovery utility program can't handle the problem for you. The reason is that it's likely that some intermediate entry in the FAT was corrupted, and the lost chain is just the end of the file with the invalid cluster number.

HEAVY WEATHER

The errors I've just discussed involve either a single file or only a few files. Serious stuff, but likely not catastrophic—unless the file happens to be the only copy of the company's annual report! The remaining errors are those that make your stomach turn.

The least threatening of these errors is the report

```
Invalid sub-directory entry
Convert directory to file (Y/N)?
```

Tread very carefully here, for you could easily lose access to a directory and all its subdirectories. This message indicates that CHKDSK has found a file that has the directory attribute but fails to have some expected feature, such as a . file (a self reference directory listing). Again, this is the kind of problem that the major utilities can generally handle automatically. If you're stuck with using CHKDSK, here's what you face.

If the problem is simply that the attribute byte has been wrongly set to indicate a directory rather than a normal file, then answering Y to CHKDSK /f is fine. On the other hand, if a genuine subdirectory whose . or . . entries got fouled is involved, you must answer N.

If you know you're dealing with a directory, try to move into its subdirectories. If they seem all right, copy them elsewhere and delete the originals. After moving everything out of the directory and removing all its subdirectories, you can then let CHKDSK /f turn the directory into a file and delete it. This done, make a new directory and restore the files and subdirectories you saved.

Lab Notes

CMOS INFORMATION

Another problem you may encounter involves the disk information stored in your system's CMOS memory. The BIOS requires a disk *type* number if it is to read the disk. The symptoms of a bad disk type are typically a nonsensical root directory reading and an unbootable hard disk—but one that can be accessed if you boot from a floppy. Often this problem is accompanied by other symptoms of corruption of your CMOS data—bad date and time, with perhaps even an insistence that you run setup.

To solve this problem, you will have to run the setup program that came with your computer (it's an on-line option during bootup on some machines). This will allow you to enter the proper type number, which reflects the physical characteristics of your disk.

This being so, you'd better know your disk type number! If you don't, run setup while there is no problem and see what it tells you. Then write that all-important

number down in a safe place. If you're reading this after the problem is already to hand, pray that yours is one of the hard disks that list their disk type on the physical disk—or that your hardware supplier will be able to help.

Typically, two things cause CMOS corruption. One is that a program crashes horrendously and winds up writing junk to the wrong processor port, thereby clobbering the CMOS data. You'll know if that has happened because the Power On Self Test (POST) will report an error or your system won't boot after the crash.

The other cause—which manifests itself when your CMOS data gets lost for no apparent reason—is that your CMOS battery is low. In such a case, you'll be able to run setup successfully, but keep an eye open and, if the problem recurs, replace the battery.

The final disk problem I'll consider here takes us back to the starting point of this series: Your boot sector or partition table gets corrupted. The symptoms are that the disk is not recognized, even if you boot from a floppy: FDISK does not recognize it, and no hardware error is indicated during bootup.

Traditionally, the solution required you to use *The Norton Utilities* to make a copy of the critical disk sectors and to try to restore them by hand. Without such preparation—and often with it—the result was the need to reformat, causing you to lose everything since your latest backup. That situation changed radically when *Norton 4.5* was introduced in late 1988. The *Norton Disk Doctor*—and now the similar programs found in *Mace* and *PC Tools*—will save you from the catastrophic loss of the original Partition Table.

But disk disasters aren't *all* that these utilities are good for. Each provides a disk *FORMAT* program far superior to that of DOS, for example, and each offers a panoply of options for eliminating file fragmentation. As these programs have become successively more powerful (and similar!) they have become more oriented toward preventive maintenance and easy operation. In short, apart from a hardware breakdown, if your disk goes south and you're not equipped to fix it, the real failure is not in the disk. ■

Barry Simon is a contributing editor of PC Magazine.

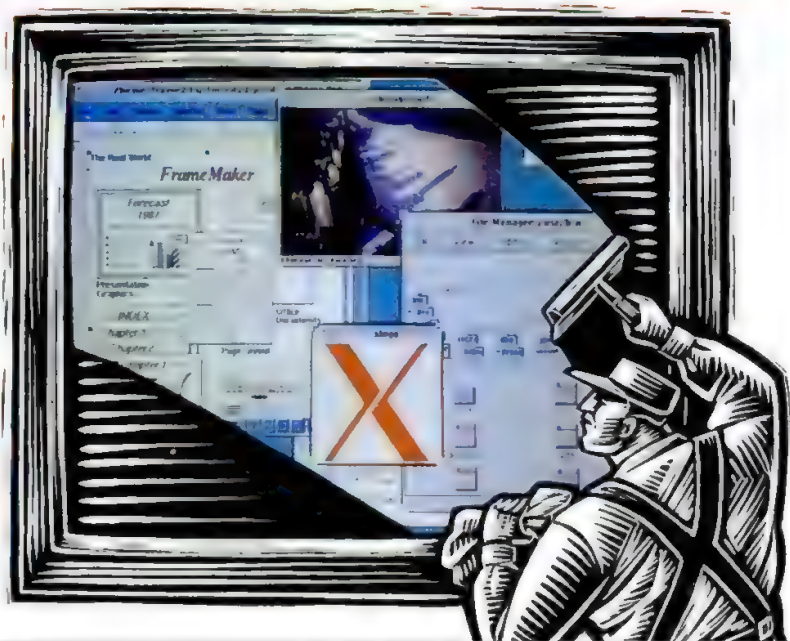
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by
Neil J. Rubenking

Utilities

Do you know the number of different ways a deck of cards can be shuffled? The answer—52 factorial—is 80,658,175,170,943,878,571,660,636,856,403,766,975,289,505,440,883,277,824,000,000,000,000. But don't expect to calculate this number using any ordinary PC program.

Most programming languages support two basic kinds of numeric variables: integer and floating-point. The number of values integer variables can represent is fixed by the number of bytes used to store them—generally 1, 2, or 4 bytes. Calculations using integer variables, while completely accurate, are not suitable for extremely large numbers.

Floating-point variables can cover a vastly larger range of numbers than integers; however, these variables are limited to a fixed number of significant digits. This means that any program that performs floating-point calculations is subject to round-off errors. Such errors are cumulative, so after a series of calculations it's more than likely that the result may be off by quite a wide margin.

The HUGEALC utility presented in this issue avoids the problems associated with both integer and floating-point variable types by representing numbers as strings of ASCII digits. It works with extremely large numbers yet maintains complete accuracy.

The key to HUGEALC's operation is the realization that given a sufficient amount of time, patience, and paper, you could evaluate an expression such as 2^{100} . That is to say, you have no built-in limit on the size of the numbers you can figure with, and the manual techniques of multiplication, addition, subtraction, and so on have no intrinsic limits. By making the computer perform math in the same way you would, I've vastly expanded the range in which it can perform accurate calculations with every digit significant.

HUGEALC can generate results of up to 254 digits, and in theory its inputs can have up to 253 digits. In practice, however, the DOS command line maximum

HUGEALC Handles Humongous Numbers Easily and Accurately

■ When you need up to 254 significant digits in a calculation, neither floating-point nor integer arithmetic programs for the PC will suffice. But HUGEALC will.

length of 127 characters limits the input length.

You can download the executable and source files from PC MagNet in one file (HC.ZIP) or as separate files (HC.EXE, HC.PAS, and CALC.PAS). Instructions for downloading appear on the PC MagNet News page, which follows this article. You can use HUGEALC as is, or you may wish to include its functions in your own Turbo Pascal programs. In the latter case, note that the Pascal source files require Turbo Pascal 6.0 to compile. If your communications setup is not equipped to handle binary files, you should download HC.BAS instead. When you run this once in BASIC, it will create the executable file for you. If you don't have a modem at all, you can get a copy of the source code by mail or fax. Simply send a postcard with your name and address (or fax number if applicable) to the attention of Katherine West, Utilities, *PC Magazine*, One Park Avenue, New York, NY 10016; no phone calls, please.

USING HUGEALC

HUGEALC is a command-line six-function calculator: It performs the standard four arithmetic functions (addition, sub-

traction, multiplication, and division), to which it adds exponentiation and factorial functions. The basic syntax for HUGEALC is

HC *n operator n*

where the values of *n* (the *operands*) consist of one or more digits. Note that the syntax assumes you will name the executable HC, just as I have done, to avoid typing out HUGEALC everytime. You should also note that no commas or other formatting characters are permitted and that the operands must be positive numbers. The six recognized operators are +, -, *, and /, together with ^ for exponentiation and ! for factorial. All operators except factorial require two operands, though (as discussed below) the first operand may come from DOS Standard Input rather than the command line. In addition, there must be at least one space separating the operator and each operand.

The format in which HUGEALC presents its results depends on their destination. If you simply ask the program to display its results on the screen (the default) or if you redirect its output to a printer or another device, HUGEALC first prints the name of the function and then prints the numeric result with commas inserted every three digits. HUGEALC begins inserting the commas at the end of the number and works back toward the beginning. If inserting another comma would make the output string longer than 255 characters, HUGEALC simply stops adding commas. For example, in the following calculation HUGEALC has no room for the last two commas.

Utilities

HC 2 ^ 640

```
POWER: 4362440,617,622,195,218,
641,171,605,780,291,324,893,228,50
7,240,559,930,579,192,517,899,275,
167,200,677,386,505,912,811,317,37
1,399,770,642,309,573,594,407,310,
600,704,721,375,437,998,252,661,31
9,722,214,100,251,994,674,360,264,
950,002,874,192,246,603,776
```

However, if you redirect the output to a file or pipe it to another program, HUGE-CALC omits the function name and the commas altogether. In this format the program output can serve as an input operand for HUGE-CALC itself. This means that you can store partial results in a file and feed them to HUGE-CALC later, using the redirection symbol (<), or you can chain together HUGE-CALC commands with the

pipng symbol (|).

If HUGE-CALC's input is redirected from a file or piped from another program, it treats the DOS Standard Input as its first operand. For example, here are two ways to calculate 2^{100} minus 1:

```
HC 2 ^ 100 > temp.dat
HC - 1 < temp.dat
or
HC 2 ^ 100 | HC - 1
```

A more extensive example of the use of piping to extend the reach of HUGE-CALC beyond a single calculation may help you in planning sequential calculations of your own. Suppose you have a program that prints all the possible permutations of a given number of characters. If the program can calculate 10,000 permutations per second, how long will it take to print all the combinations of 13 characters? Running the HUGE-CALC command line below will show you in seconds that the answer is

measured in days.

```
HC 13 ! | HC / 10000 | HC / 3600 |
HC / 24
```

Following through the steps above, we first calculate 13 factorial and pass the result to another instance of HUGE-CALC, which divides that result by 10,000. The result of this calculation is the number of seconds. We pipe that number along and divide it by 3,600, the number of seconds in an hour. And we divide *that* result by the number of hours in a day. The result is 7, with a remainder of 4, so the task will take a bit over a week.

Please note that chaining together calls to HUGE-CALC.EXE by piping the output of one to the input of another is strictly a sequential process. Thus, for example, you could not use it to calculate $(52^{52})/(52!)$.

HC.EXE has one other limitation: a minor incompatibility with the popular DOS

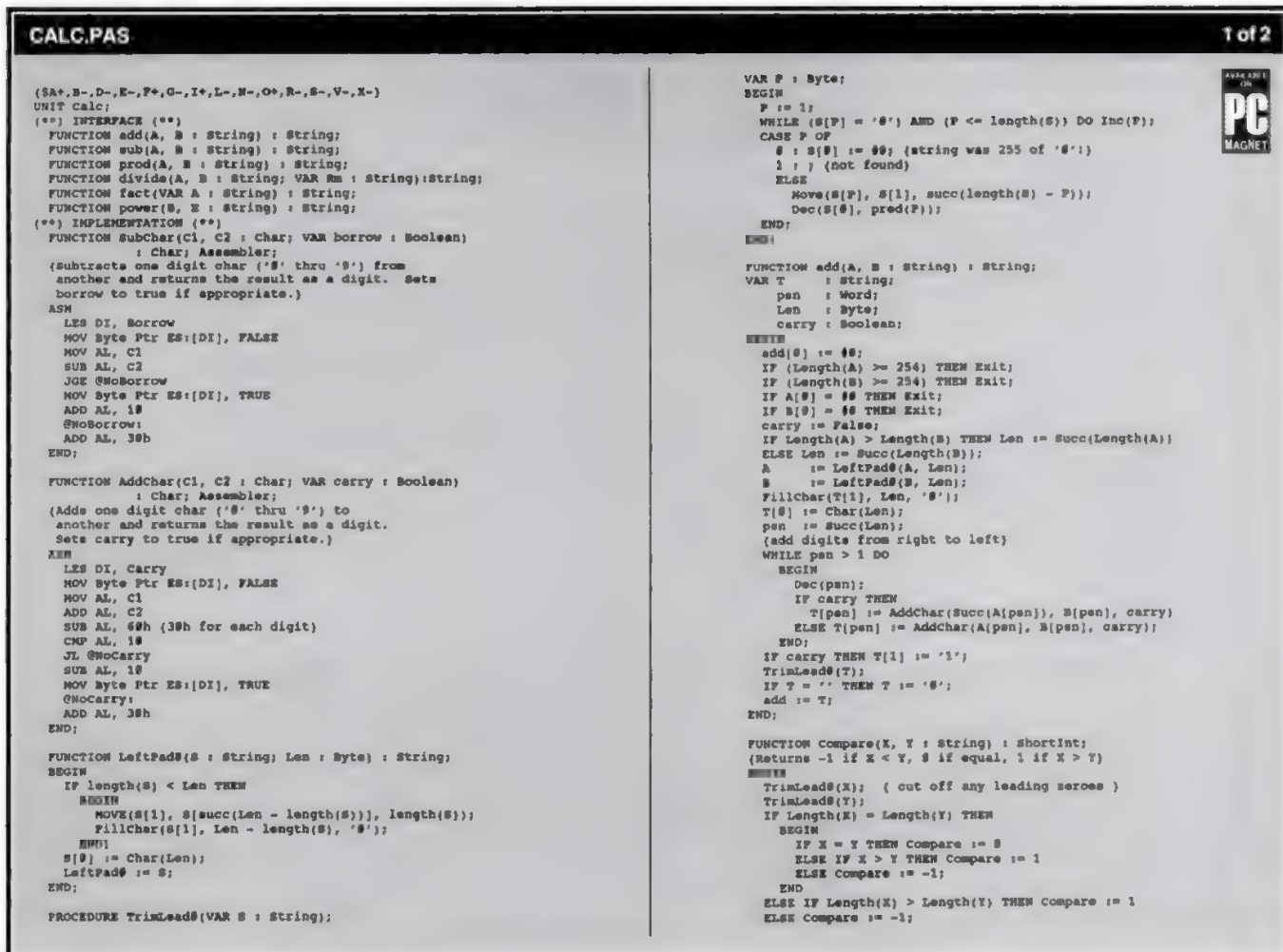


Figure 1: The Turbo Pascal 6.0 routines in the CALC unit perform calculations on numeric strings.

CALC.PAS

2 of 2

```

END;

FUNCTION sub(A, B : String) : String;
VAR T : String;
    pen, Len : Word;
    borrow, minus : Boolean;
BEGIN
    sub[0] := #0;
    IF (Length(A) >= 254) THEN Exit;
    IF (Length(B) >= 254) THEN Exit;
    IF A[0] = #0 THEN Exit;
    IF B[0] = #0 THEN Exit;
    borrow := False;
    minus := False;
    (subtract smaller from larger)
    IF Compare(A, B) = -1 THEN
        BEGIN
            minus := True;
            T := A; A := B; B := T;
        END;
    IF Length(A) > Length(B) THEN Len := Succ(Length(A));
    ELSE Len := Succ(Length(B));
    A := LeftPad(A, Len);
    B := LeftPad(B, Len);
    FillChar(T[1], Len, '0');
    T[0] := Char(Len);
    pen := Succ(Len);
    (subtract digits from right to left)
    WHILE pen > 1 DO
        BEGIN
            Dec(pen);
            IF borrow THEN
                T[pen] := subChar(pred(A[pen]), B[pen], borrow);
            ELSE T[pen] := subChar(A[pen], B[pen], borrow);
        END;
        TruncLead(T);
        IF T = '' THEN T := '0';
        IF minus THEN
            BEGIN
                Move(T[1], T[2], length(T));
                T[1] := '-';
                Inc(T[0]);
            END;
        sub := T;
    END;

FUNCTION prod(A, B : String) : String;
VAR T1, T2 : String;
    ppen, times, M : Word;
BEGIN
    prod[0] := #0;
    IF (Length(A) + Length(B) > 254) THEN Exit;
    IF A[0] = #0 THEN Exit;
    IF B[0] = #0 THEN Exit;
    (multiply larger by smaller)
    IF Compare(A, B) = -1 THEN
        BEGIN
            T1 := A; A := B; B := T1;
        END;
    T2 := '0';
    (for each digit of multiplier, right to left,
    add together an appropriate number of copies
    of multiplicand, tack the right number of
    zeroes on the end, and add the result to the
    running total in T2)
    FOR ppen := Length(B) DOWNTO 1 DO
        BEGIN
            times := Ord(B[ppen])-48;
            IF times = 0 THEN T1 := '0'
            ELSE
                BEGIN
                    T1 := A;
                    FOR M := 2 to times DO
                        T1 := add(T1, A);
                    END;
                    FillChar(T1[succ(length(T1))],
                        length(B)-ppen, '0');
                    Inc(T1[0], length(B)-ppen);
                    T2 := add(T2, T1);
                END;
        prod := T2;
    END;

FUNCTION divide(A, B : String; VAR Rm : String):String;

```

```

VAR T1, T2, T3 : String;
BEGIN
    divide[0] := #0;
    Rm[0] := #0;
    IF A[0] = #0 THEN Exit;
    IF B[0] = #0 THEN Exit;
    IF Compare(A, B) = 0 THEN
        BEGIN
            divide := '1';
            Rm := '0';
        END;
    ELSE
        BEGIN
            T1 := B; T2 := '1'; T3 := '0';
            (While dividend is > T1, add zeroes to
            T1 and to T2)
            WHILE Compare(A, T1) = 1 DO
                BEGIN
                    Inc(T1[0]); T1[length(T1)] := '0';
                    Inc(T2[0]); T2[length(T2)] := '0';
                END;
            (get individual digits of quotient by
            repeated subtraction of T1. T1 is the
            divisor with a steadily decreasing number
            of zeroes after it.)
            WHILE Compare(T1, B) <> 0 DO
                BEGIN
                    Dec(T1[0]);
                    Dec(T2[0]);
                    WHILE Compare(A, T1) <> -1 DO
                        BEGIN
                            A := sub(A, T1);
                            IF A[0] = #0 THEN Exit;
                            T3 := add(T3, T2);
                            IF T3[0] = #0 THEN Exit;
                        END;
                    divide := T3;
                    Rm := A;
                END;
            END;

FUNCTION fact(VAR A : String) : String;
VAR T1, T2 : String;
BEGIN
    T1 := '1';
    T2 := '1';
    IF (A <> '1') AND (A <> '0') THEN
        WHILE (T2 <> A) AND (T1[0] <> #0) DO
            BEGIN
                T2 := add(T2, '1');
                T1 := prod(T1, T2);
            END;
    fact := T1;
END;

FUNCTION power(B, E : String) : String;
VAR T1, T2, T3, Rem : String;
BEGIN
    power[0] := #0;
    IF B[0] = #0 THEN Exit;
    IF E[0] = #0 THEN Exit;
    power := '0';
    IF B = '0' THEN Exit;
    power := '1';
    IF E = '0' THEN Exit;
    T1 := B;
    T2 := E;
    T3 := '1';
    (calculate power by halving and squaring)
    WHILE (T2 <> '0') AND (T3[0] <> #0) DO
        BEGIN
            (halve the exponent)
            T2 := divide(T2, '2', rem);
            (if it was odd, multiply T3 by current
            value of T1)
            IF rem = '1' THEN
                T3 := prod(T3, T1);
            (square T1)
            T1 := prod(T1, T1);
        END;
    power := T3;
END;
END.

```

command line utility CED. CED lets you enter several commands on a single command line, but by default it separates them with a caret (^). Thus, if you have CED loaded, the command line

HC 52 ^ 52

will be interpreted as two distinct commands: HC 52 (which results in an error

message) and 52 (which causes a "Bad command or filename" message from DOS). The solution is to change CED's chain character, at least temporarily. The command

CED CHAINCH C

will cause CED to use ASCII character 128 as its chain character, leaving the caret

free for use by HUGEALC. (You could, of course, use another uncommon character to replace the CED chain character.)

THE CALC UNIT—HUGEALC'S BRAIN

The CALC.PAS unit listed in Figure 1 consists primarily of the operator functions Add, Sub, Prod, Divide, Fact, and Power. These work on numbers expressed as numeric strings. The most important func-

BASM, TURBO PASCAL 6.0'S BUILT-IN ASSEMBLER

by Neil J. Rubenking

Programmers will be happy to learn that, beginning with Version 6.0, Turbo Pascal has built a simple assembler right into the Integrated Development Environment (IDE). BASM handles all 8088/8086 machine code instructions, and—given the proper compiler directives—it supports 8087, 80286, and 80287 operations as well. BASM doesn't provide the full scope of a stand-alone assembler; it mostly handles only ASM instructions, not directives like `ORG`, `STRUCT`, or `EQU`. The data directives `DB`, `DW`, and `DD` (Define Byte, Define Word, and Define Double-word) are supported, though only for preinitialized values.

To use the TP 6.0 built-in assembler, you simply insert a block of assembly instructions into your program, preceded by the new keyword `ASM` and ending with `END`. The instructions can refer to Pascal constants, variables, and procedures by name. It's a vast improvement over using `INLINE` code or external assembler files.

BASM BENEFITS

When you switch to BASM from `INLINE`, you no longer have to consult an assembler reference or shell out of the IDE and run `DEBUG` to figure out the bytes for a particular combination of assembly instructions and operands. As long as you know the name of the instruction you want, you just type it in. In `INLINE`, by contrast, it's not enough to know the name, because in combination with different operands the same instruction is represented by different bytes. For example, you have to distinguish among bytes used for moving data into a register when the source is a local variable, a global variable, a constant, or an argument to a procedure or function.

A second advantage is that BASM completely eliminates the onerous task of calculating offsets for `JUMP` instructions. When using `INLINE` you'd probably find yourself counting aloud in hex while pointing at bytes on the screen—

or, worse yet, counting backward in hex if the jump was to a prior address. And if you insert or delete any bytes in an `INLINE` block, you have to check all the jumps again. If a change to the code moves a conditional jump destination beyond the range of -128 to 127 bytes, you have to recode the jump, and *that* change means you have to recalculate all the other jumps again!

BASM handles this messy process invisibly. You simply write your jump instruction and point it at a label. If the label is too far away for a conditional jump, BASM doesn't flinch. Instead, it generates two jump instructions. The first is a conditional jump on precisely the opposite of the condition you specified. It jumps over the next instruction, which is an unconditional jump to the requested destination. If you were writing `INLINE` code, you'd have to do this yourself; with BASM you don't even think about it.

Having the assembler built-in is also an improvement over using an external assembler. Each time you make a change to an external routine, you must leave the IDE, assemble your modified ASM program, reenter the IDE, and recompile. To debug external ASM code, you have to use the separate Turbo Debugger. But if you write your code in BASM you can step through it line by line in the IDE while watching the registers in a Registers window. You can even set conditional breakpoints on the value of the CPU registers!

ASM PROCEDURES AND FUNCTIONS

If a procedure or function contains nothing but ASM code, you can increase its efficiency by appending the Assembler directive to its header. Such a routine can no longer have a `BEGIN`; it begins with the `ASM` keyword. The compiler performs some special optimizations on such routines:

- It does not generate code to make local copies of value parameters that aren't 1, 2, or 4 bytes in size.
- Except for string functions, it does not define a function result variable.

■ If the routine has no parameters or local variables, the compiler does not generate a stack frame.

■ The entry and exit code for the procedure is reduced to what is necessary to handle its local variables and parameters; it may be reduced to nothing but a `RET` or `RETF` at the end.

With everything superfluous stripped away, these routines can be *fast*!

WHEN TO USE BASM

When Turbo Profiler indicates that a certain routine is a bottleneck in your program, the first thing to do is consider whether the algorithm itself is as efficient as possible. If you're confident on this score, then you may want to rewrite the algorithm in BASM to speed it up. The first thing to do is examine the assembler code generated by the slow area. You can use the View/Disassembly window in Turbo Profiler or the View/CPU window in Turbo Debugger for this. The latter may be more useful, since it gives you the option of dumping the disassembly to a log file.

When a seemingly simple line of Pascal causes one or more calls to routines in the runtime library, that's a good sign that you may be able to improve on it. And if a series of Pascal lines cause a variable to be loaded into the CPU registers again and again, you can probably speed things up by writing BASM code to keep it in a register.

Don't use BASM when you can do what you need to just as well in Pascal. The DOS Unit is loaded with built-in routines that give direct access to DOS functions, and you can make simple calls to almost any other DOS or BIOS functions with the `MSDOS` and `INTR` procedures. For direct access to any area of conventional RAM, use the `MEM` and `MEMW` arrays, or declare a variable `ABSOLUTE` at the desired location. And to read and write the I/O ports, use the `PORT` and `PORTW` arrays. If you don't need BASM, don't use it. After all, plain Pascal code is vastly easier to read and change. ■

Utilities

tions in CALC.PAS, however, are the simple AddChar and SubChar routines, which add and subtract single digits represented by ASCII characters. All of the string routines in the CALC unit depend on these two simple functions, and since they're going to be called a lot, for the sake of speed I wrote them as assembly language functions. The sidebar "BASM, Turbo Pascal 6.0's Built-in Assembler," explains how they are integrated into the main program.

Besides taking into account that the value of an ASCII digit is 30h greater than the number it represents, there's nothing really unusual about the AddChar and SubChar functions. SubChar begins by moving FALSE into the borrow parameter. It takes the difference of the two arguments and notes whether the result is less than 0. If so, it adds 10 to the result and sets the borrow parameter to TRUE. Finally, it adds 30h to the result to convert it back to an ASCII numeric character.

AddChar is very similar. After adding the two digits, AddChar subtracts 60h from the total; that's quicker than subtracting 30h from each parameter individually. It then checks whether the result was greater than 10. If so, it sets the carry parameter and subtracts 10 from the result. Finally it adds 30h to the result to convert it back into an ASCII digit.

ADDING NUMERIC STRINGS

You learned as a child that you can add two large numbers simply by adding the digits from right to left and carrying a 1 to the next place if the sum exceeded 9. And you learned to subtract one digit at a time, borrowing from the next place if the subtraction would result in a negative number.

The Add function adds two numeric strings together in exactly the way you would add them on paper. First of all, the Add function sets its result to an empty string, which is the signal for an error. If one of the input strings is empty or longer than 253 characters, the Add function exits, leaving its result set to the empty string.

If the input strings are valid, Add left-pads each with zeros to one more than the length of the longer one and creates a result string of the same length, also filled with zeros. It then steps through the strings from the last character to the first, adding

the digits from the two input strings and storing the resulting digit in the result string. At each step of this process, if there's a carry pending, it adds 1 to the next digit to the left.

After processing the input strings, the Add function checks to see if the very last addition produced a carry. If so, it sets the first digit of the result string to 1. Then it trims leading 0s. If the result of the trim function is the empty string, it replaces it with the string '0', since that is used to signal an error.

**The most important
functions in CALC.PAS
are the simple
AddChar and SubChar
routines, which add
and subtract single
digits represented by
ASCII characters.**

SUBTRACTING NUMERIC STRINGS

Subtracting numeric strings takes only a little more effort than adding them. If the second parameter is greater than the first, the variable minus is set to TRUE and the two parameters are swapped. This way the smaller number is always subtracted from the larger. Note that a special function is needed to determine which of two numeric strings is larger; if you simply used the built-in > and < operators straightaway, you'd find that '4' is greater than '100'. After leading zeros are removed, if the strings are of different lengths, the longer is the larger. If they're the same length, then they can be compared using Turbo Pascal's > and < operators. The Compare function implements this simple algorithm, returning -1 if its first parameter is less than the second, 1 if the first parameter is greater, and 0 if they're equal.

As with the Add function, Sub first sets its function result to the empty string and exits if either of the input strings is invalid.

If both are valid, they're checked to determine which is larger and, if necessary, they are swapped. Then the smaller is sub-

tracted from the larger, from right to left, one character at a time, borrowing as necessary. If the minus variable is TRUE, a minus sign is inserted at the beginning of the result.

MULTIPLYING NUMERIC STRINGS

When you multiply two strings on paper you write the smaller below the larger and multiply the larger by each individual digit of the smaller. You write each partial product below the previous one, offsetting it to the left by one more decimal place. Finally, you add all of the partial products to get the result. That's exactly how HUGE-CALC multiplies numeric strings.

If the sum of the lengths of the two operands, A and B, is greater than 254, the result will be too large to represent as a numeric string, so Prod (the multiply function) exits with the result set to the empty string. It does the same if either operand is empty. Then Prod checks which operand is larger and, if necessary, swaps them to make B the smaller of the two.

The variable T1 holds the partial product for each digit, and T2 maintains a running total of all the partial products. T2 is initialized to '0'. Prod then steps through the characters of operand B one at a time, from right to left. If the current digit is '0' it simply sets the partial product T1 to '0'. Otherwise, T1 is set to the value of operand A, which is repeatedly added to itself to get the desired multiple. Zeros are appended to the result to produce the equivalent of writing the partial product offset to the left. Then T1 is added to the running total in T2. When A has been thus multiplied by each of the digits in B, T2 holds the result, so the last step is simply to return the value of T2.

DIVIDING NUMERIC STRINGS

When it comes to division, the easy analogy with pencil-and-paper math breaks down. As multiplication was accomplished by repeated addition, so division must be done by repeated subtraction. After the initial check for valid parameters, the Divide function sets up three temporary variables. T1 initially gets the value of the divisor (parameter B). T2 is set to '1' and T3 to '0'. Then zeros are appended to both T1 and T2 until T1 is not less than the dividend (parameter A). As a result, T1 now contains the divisor times some power of 10, and T2 contains that power of 10. The result will be accumulated in variable T3. Now Divide is ready to perform some repeated subtraction.

Utilities

Remember that T1 started off with the same value as the divisor—but with a number of added zeros. The main loop continues while T1 is not equal to the divisor; each time through the loop, the last zero is chopped from the end of both T1

and T2. Hence T1 is always equal to T2 times the divisor B. The inner loop keeps subtracting T1 from the dividend A until A is less than T1, and each time through this loop T2 is added to the accumulator T3. After all possible subtractions, the quotient is in T3 and the remainder is what's left of A. You'll want to trace through this procedure a few times, however, to assure yourself that it really does perform division!

NUMERIC STRING FACTORIALS

With the four basic functions in place, calculating factorials by repeated multiplication is a snap. Note, however, that the Fact function must be nonrecursive. A recursive string-based factorial function would use a minimum of 512 bytes of stack for each level of recursion. You can calculate the factorial of numbers as high as 144 without overrunning the length of a numer-

HUGEALC.PAS
COMPLETE LISTING

```

($A+,B-,D-,E-,F+,G-,I+,L-,M-,R-,S-,V-,X-)
($M 16384,0,0)
PROGRAM HugeCalc;
USES Calc;
CONST Copyright : String[82] = 'HUGEALC 1.0, Copyright 1991 by '+
  'Neil J. Rubenking';
FUNCTION AllNums(VAR A : String) : Boolean;
VAR N : Byte;
BEGIN
  AllNums := FALSE;
  FOR N := 1 to length(A) DO
    IF (A[N] < '0') OR (A[N] > '9') THEN Exit;
  AllNums := TRUE;
END;

FUNCTION IsDevice(VAR F : Text) : Boolean; Assembler;
ASM
  MOV AX, 44h      (IOCTL function)
  MOV AL, 80h      (get device info subfunction)
  LES DI, F
  MOV BX, ES:[DI]  (handle in BX)
  INT 21h
  MOV AL, 0        (return value is FALSE)
  JC @end
  TEST DX, 80h     (check is-device bit)
  JZ @end          (if NOT set, just and)
  INC AL           (return value is TRUE)
@end
END;

VAR op, operand, result, rem : String;
    operation : Char;

FUNCTION GotParams : Boolean;
  ( PURPOSE : Returns true if parameters are
    correctly passed on the command line -- and
    assigns them to the correct variables if so.)
VAR S : String[1];
    B : Byte;
BEGIN
  GotParams := FALSE;
  B := 2;
  IF (NOT IsDevice(Input)) AND NOT EOF(Input) THEN
    BEGIN
      ReadLn(Op);
      Dec(B);
    END;
  IF ParamCount < B THEN
    BEGIN
      WriteLn(Copyright);
      WriteLn('Enter "MC $1 op $2", '
        'where op is +,-,*,/, or ^');
      WriteLn('or "BC $1" for factorial');
      Exit;
    END;
  IF B = 2 THEN op := ParamStr(1);
  IF NOT AllNums(op) THEN
    BEGIN
      WriteLn(Copyright);
      WriteLn('"'op," is not a positive integer.");
      Exit;
    END;
  S := ParamStr(B);
  operation := S[1];
  CASE operation OF
    '+', '-', '*', '/', '^' : BEGIN
      IF ParamCount < succ(B) THEN
        BEGIN
          WriteLn(Copyright);
          WriteLn('The operator ',operation,
            ' requires a second operand. ');
          Exit;
        END;
      Operand := ParamStr(B+1);
      IF NOT AllNums(Operand) THEN
        BEGIN
          WriteLn(Copyright);
          WriteLn('"'operand," is not a positive integer. ');
          Exit;
        END;
    END;
  ELSE
    BEGIN
      WriteLn(Copyright);
      WriteLn('Valid operations are +,-,*,/, ^ and ^');
    END;

```

```

      Exit;
    END;
  GotParams := TRUE;
END;

FUNCTION AddComma(WN : String) : String;
VAR posn, MinLoc : Word;
BEGIN
  IF WN = '' THEN AddComma := 'ERROR'
  ELSE
    BEGIN
      posn := succ(length(WN));
      MinLoc := 4;
      IF WN[1] = '-' THEN Inc(MinLoc);
      WHILE (posn > MinLoc) AND (length(WN) < 255) DO
        BEGIN
          Dec(posn, 3);
          Move(WN[posn],
            WN[succ(posn)],
            succ(length(WN)-posn));
          WN[posn] := ',';
          Inc(WN[0]);
        END;
      AddComma := WN;
    END;
  END;

BEGIN
  IF GotParams THEN
    BEGIN
      CASE operation OF
        '+': BEGIN
          IF IsDevice(Output) THEN
            Write(' SUM: ');
          result := add(op, operand);
          IF IsDevice(Output) THEN
            WriteLn(AddComma(result));
          ELSE WriteLn(Result);
        END;
        '-': BEGIN
          IF IsDevice(Output) THEN
            Write(' DIFFERENCE: ');
          result := sub(op, operand);
          IF IsDevice(Output) THEN
            WriteLn(AddComma(result));
          ELSE WriteLn(Result);
        END;
        '*': BEGIN
          IF IsDevice(Output) THEN
            Write(' PRODUCT: ');
          result := prod(op, operand);
          IF IsDevice(Output) THEN
            WriteLn(AddComma(result));
          ELSE WriteLn(Result);
        END;
        '/': BEGIN
          IF IsDevice(Output) THEN
            Write(' QUOTIENT: ');
          result := divide(op, operand, rem);
          IF IsDevice(Output) THEN
            WriteLn(AddComma(result));
            Write(' REMAINDER: ');
            WriteLn(AddComma(rem));
          ELSE
            WriteLn(Result);
          END;
        '^': BEGIN
          IF IsDevice(Output) THEN
            Write(' FACTORIAL: ');
          result := fact(op);
          IF IsDevice(Output) THEN
            WriteLn(AddComma(result));
          ELSE WriteLn(Result);
        END;
        '^': BEGIN
          IF IsDevice(Output) THEN
            Write(' POWER: ');
          result := power(op, operand);
          IF IsDevice(Output) THEN
            WriteLn(AddComma(result));
          ELSE WriteLn(Result);
        END;
      END;
    END;
  END;
END.

```

Figure 2: The HUGEALC program lets you perform math operations involving huge numbers while retaining complete accuracy.

PC MAGAZINE UTILITIES UPDATES

Like all good software, the programs presented in *PC Magazine* are upgraded and improved. You can get the modified versions by downloading them from PC Mag-Net. Here's a partial list of the programs that have been upgraded to fix minor bugs and system incompatibilities:

ANSI.COM, Version 1.3
BAT2EXEC.COM, Version 1.3
BCOPY, Version 1.2
BEN56.ARC (Benchmark Series, Version 5.6)
CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.2
CMDEDIT.EXE, Version 2.1
CONFIG.CTL, Version 3.0
DIRMATCH.COM, Version 2.0
EMMA.COM, Version 2.2
EMS40.SYS, Version 1.1
PANDORA.COM, Version 1.5a
PCACCESS.COM, Version 1.1
PCMANAGE.EXE, Version 1.1
PCREMOTE.COM, Version 1.1
RN.COM, Version 2.0
SCHEDULE.COM, Version 1.1
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
TPFST-AT.COM, Version 1.1
ZCOPY.COM, Version 1.2

For a complete list of all the programs available from the PC Mag-Net Software and Utilities Database Library, download UDCAT.ARC.

A downloadable index to *PC Magazine's* product reviews is also available. PCM.EXE is a self-extracting file that contains the *Computer Library PC Magazine Reviews Index* for January 1988 to December 1990. It requires the search files in PCSRCH.EXE. Please read the information file PCM.INF before you download any of these files.

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Neil Rubenking

HUGEALC Command

September 24, 1991 (Utilities)

Purpose:

A command line calculator that can perform addition, subtraction, multiplication, division, exponentiation, and factorial functions on numbers with up to 254 significant digits.

Format:

HC *n operator [n]*

Remarks:

The *n* operand variables can consist of any string of digits up to the 127-character maximum of the DOS command line. The operands must not include commas or other formatting punctuation and must be separated from the command and the operator by at least one space. Two operands are required for all operations except factorial. The operators recognized are +, -, *, /, ^, and !.

When output to the screen (the default) or redirected to a printer or other DOS device, HUGEALC prints the name of the function and inserts commas at every three digits in the numeric result. If the output is redirected to a file or piped to a program input, however, only the numeric result is sent. Note that when it accepts input from a file or via a pipe, HUGEALC uses that input as its *first* operand.

Example:

If a program that prints 10,000 permutations per second is asked to print all possible combinations of 13 characters, how long will it take? The command

```
HC 13 ! | HC / 10000 | HC / 3600 | HC / 24
```

pipes the factorial of 13 (the possible combinations) to a second instance of HC, which divides it by 10,000 (the permutations per second). The result is piped to a third instance of HC, which divides it by 3,600 (the seconds in an hour), and finally to a fourth instance of HC, which divides it by 24 (the hours in a day). The answer printed on the screen is

```
QUOTIENT: 7
REMAINDER: 4
```

that is, 7 days, 4 hours.

Note that all such chained calculations must be strictly sequential and that parenthetical expressions are not supported.

Utilities

ic string, but with recursion it would require an impossible 72K of stack.

The Fact function uses T2 as a counter and T1 as an accumulator and starts by setting both to '1'. If the input value is '0' or '1', it's done. If not, Fact loops repeatedly, adding 1 to the counter and multiplying the accumulator by the current value of the counter. Then all you have to do is return the final value of the accumulator.

NUMERIC STRING EXPONENTIATION

The most common way of calculating a power in Turbo Pascal is to use the Exp and Ln functions: $XY = \text{Exp}(Y * \text{Ln}(X))$. However, these functions aren't available for numeric strings. You could perform exponentiation by repeated multiplication, but that method is potentially very slow. Fortunately, there's a clever technique called "halving and squaring" that perfectly suits the Power function.

Here's how it works. First, if the base is 0, you return 0. If the exponent is 0, you return 1. Otherwise, you set T1 to the base, T2 to the exponent, and T3, the accumulator, to '1'. Then you begin halving and squaring. Each time through the loop you halve T2, the exponent. If the remainder is 1, you multiply the accumulator by the current value of T1. Then you square T1. This process continues until T2 reaches '0', at which point T3 contains the desired power.

Why does this work? Try applying it to B^{13} , where B is any base value. First, translate the exponent into the sum of powers of 2; that is, $B^{(8+4+1)}$. You can now convert that to $B^8 * B^4 * B^1$ and still have an expression with the same value as B^{13} . Keeping that in mind, apply the halving and squaring algorithm. The first time through the loop, you halve T2, making it '6' with a remainder of 1. Since there was a remainder, you multiply the accumulator by T1, which contains B. This corresponds to the B^1 factor in the result. Then you square T1.

The second time through the loop, halving T2 yields '3' with no remainder. You don't change the accumulator, but when T1 gets squared again it now has the value B^4 . The third time, halving T2 yields '1' with a remainder of 1, so you multiply the accumulator by T1 (whose current value is B^4) and square T1 again. On the final pass, halving T2 leaves '0' with a remain-

der of 1. T1 now contains B^8 , and you simply multiply the accumulator by that quantity. T2 has been reduced to '0', so the loop ends, and it's clear that you have the correct result.

If you were to perform exponentiation by repeated multiplication, the number of multiplications would be directly proportional to the desired power. Double the power, and you double the number of multiplications required. With the halving and squaring method, the number of multiplications is proportional to the base 2 logarithm of the desired power. Doubling the power just adds one more set of multiplications.

Once you understand
that you can represent
numbers as strings of
digits, you're not
limited to the numeric
data types provided by
Turbo Pascal or any
other language.

MASSIVE MATH WITH HUGEALC

The HUGEALC program itself is listed in Figure 2. Its task is to take a requested calculation such as $1000000 / 3$ or $52 !$ on the command line and return the result, using the functions in the CALC unit. Almost all of the program is devoted to validating input and handling output. The numeric parameters must be positive integers, and the operator has to be +, -, *, /, ^, or !. All operators except ! require two operands. The GotParams function handles validating the parameters. If it detects that input is redirected and that input is available, it reads its first parameter from DOS Standard Input.

Assuming the GotParams function receives a valid set of parameters, HUGEALC performs the requested calculation. If output is redirected, it sends the resulting numeric string to DOS Standard Output. For screen output, it pretties up the string by inserting commas every three places. Function AddComma uses the Move pro-

cedure to insert the commas rather than Turbo Pascal's slower Insert procedure.

HUGEALC uses the Assembler function IsDevice to detect redirection of input or output. This function calls the DOS IOCTL routine for information about the file variable you pass to it and returns TRUE only if the file variable actually refers to a device. IsDevice returns TRUE for the built-in variable Output when it is not redirected or when it is redirected to a device such as the printer. It returns FALSE if Output is redirected to a file or piped to another program. The same holds for the built-in variable Input: IsDevice returns FALSE if Input is redirected from a file or piped from another program.

Note that when its output is not redirected, HUGEALC prints the name of the function (for example, SUM) before it performs the calculation. That's because some of the tasks you can assign to the program take an appreciable amount of time. Even on a fast 386 machine, calculating 100 factorial takes several seconds, and on an original IBM PC it takes almost half a minute. By putting up the function name right away, HUGEALC lets you know that something is happening!

EXTENDING HUGEALC FUNCTIONS

If you wish to exercise your programming skills, there are several directions in which you could extend the functions in the CALC unit. For one thing, there's no need to limit yourself to 254 digits. Without much trouble, you could switch to using larger arrays of characters. For another, the existing functions work only with positive numbers. With a little work, you could arrange to handle negative numbers. For example, you might modify the addition function to detect negative numbers and call the subtraction function instead. The multiplication function could note and remove the minus signs from its inputs and put a minus sign in front of its output if exactly one of the inputs was negative.

You could also expand your range by packing the digits two-to-a-byte in a BCD (binary-coded decimal) scheme. And if you're more ambitious, try adding floating-point support. Once you understand that you can represent numbers as strings of digits, you're not limited to the numeric data types provided by Turbo Pascal or any other language. ■

Neil J. Rubenking is technical editor of PC Magazine and author of PC Magazine's Turbo Pascal Techniques and Utilities.



PC MagNet News

The Latest Files and Features of PC Magazine's On-line Service

Hayes Ultra 96 Modem Giveaway

The transition from slow 2,400-bit-per-second modems to 9,600 bps has begun. Although the growth of the faster modems was limited in recent years by a jungle of standardization issues, the confusion is being cleared, partly as a result of modems that accept a variety of protocols at 9,600 bps for error checking and data compression.

CompuServe has been adding 9,600-bps access numbers in major cities and towns almost daily, allowing for faster-than-fast scrolling and downloading. Just to add to the excitement, PC MagNet has decided to give away 100 Hayes V-Series

Ultra Smartmodem 9600s ("Ultra 96s").

We are giving away a modem a day from August 7 until November 14, 1991. To enter, log on to PC MagNet as many days as you wish, anytime from now until the deadline. If you are logged on during a randomly selected 10-minute time period, you will automatically be put into a drawing held each night; thus you will be eligible to win the ZiffNet Modem Sweepstakes—and a \$999-value 9,600-bps Hayes modem.

Odds of winning depend on the number of people logging on at the randomly prescheduled time each day. Entries will be selected nightly in an indiscriminate drawing.

For complete rules and eligibility requirements, download the file RULES.TXT from the After Hours Forum, DL1, General Info.

Read the Book, Download the Disk

The popularity of computing with laptops is matched only by the incredible number of questions their use raises. In an effort to clear away some of the confusion, *PC Magazine* executive editor Bill Howard has boiled down his years of on-the-road experience into the *PC Magazine Guide to Notebook & Laptop Computers*.

The book comes with a floppy disk full of small utilities that will soften some of the rougher edges in working with your laptop. The utilities have been available on PC MagNet for some time, but to help make them even more accessible we have compiled

the utilities, executable programs, and documentation into one zipped archive (LAPTOP.ZIP).

Among the utilities that are included are TED, a tiny full-screen line editor; EMMA, for automated MCI Mail communications; PCREMOTE, to access your desktop PC remotely via modem; ZCOPY, a laptop-to-desktop file-transfer program; LITES, which shows the status of your serial or modem port; and seven others.

Indeed, this collection is a must for those who are either new or intrigued and befuddled by notebook or laptop PCs. You can find LAPTOP.ZIP in our Software and Utilities Library (GO SOFTLIB) as well as our Utilities/Tips Forum (GO UTILFORUM), DL2, PCMag Utils.—Chris Parker

- **9,600-BPS MODEM GIVEAWAY:** PC MagNet is giving away 100 Hayes Ultra 96 modems, and all you have to do is log on.
- **LAPTOP.ZIP:** Collect a zipped archive of the utilities in the *PC Magazine Guide to Notebook & Laptop Computers*.

Instant Access to PC Magazine's On-line Service

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CIRCLE 183 ON READER SERVICE CARD

by
Charles Petzold

Environments

Have you been irritated with the past several installments of the Environments column? If you have, it's probably because you have a standard 16-color EGA or VGA. I've been using the *Microsoft Windows* palette manager with a 256-color video adapter (the IBM 8514/A) in an attempt to display real-world images obtained through a color scanner and stored in device-independent bitmaps (DIBs). Current *Windows* device drivers for 16-color video adapters don't support palette manipulation; this severely limits the ability of these video adapters to display real-world images.

So what's the solution? How can you coax a 16-color video adapter with a fixed palette into rendering realistic images? Well, if you can't manipulate the palette, just about the only thing you can do is dithering. That's what I'll discuss in this column.

GRAY-SHADE DITHERING

Suppose you had a monochrome graphics video adapter such as the old IBM CGA. Such video adapters store 1 bit per pixel and are capable of displaying only black (when the bit is 0) and white (when the bit is 1). How could you display gray shades on such an adapter?

Well, you can't. But you can simulate a gray shade by dithering—combining black-and-white pixels in a pattern where different proportions of black-and-white pixels simulate different shades of gray. For example, if you wanted to color an area with one of 17 shades of gray, you'd divide the area into 4- by 4-pixel blocks. For a black area, you'd set all 16 pixels in each block to black. To color the area with a shade of gray, you'd illuminate between 1 and 15 pixels in each block, depending on how dark or light you want the gray. And to create a white area, you'd illuminate all 16 pixels.

In effect, the process of dithering increases color resolution at the expense of spatial resolution. We can define *spatial resolution* as the number of uniquely colored

Representing Real-World Images In 16 Colors

■ If you can't manipulate the palette, how can you coax a 16-color video adapter into rendering realistic images?

pixels per unit of measurement (such as dots per inch). If you need 16 pixels to define a particular color, you're decreasing the spatial resolution by a factor of 4 both horizontally and vertically. In return, you get 16 simulated colors from a monochrome device.

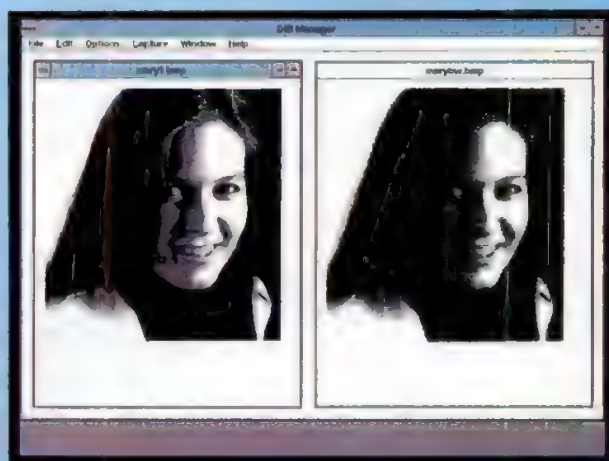
DITHERING A BITMAP

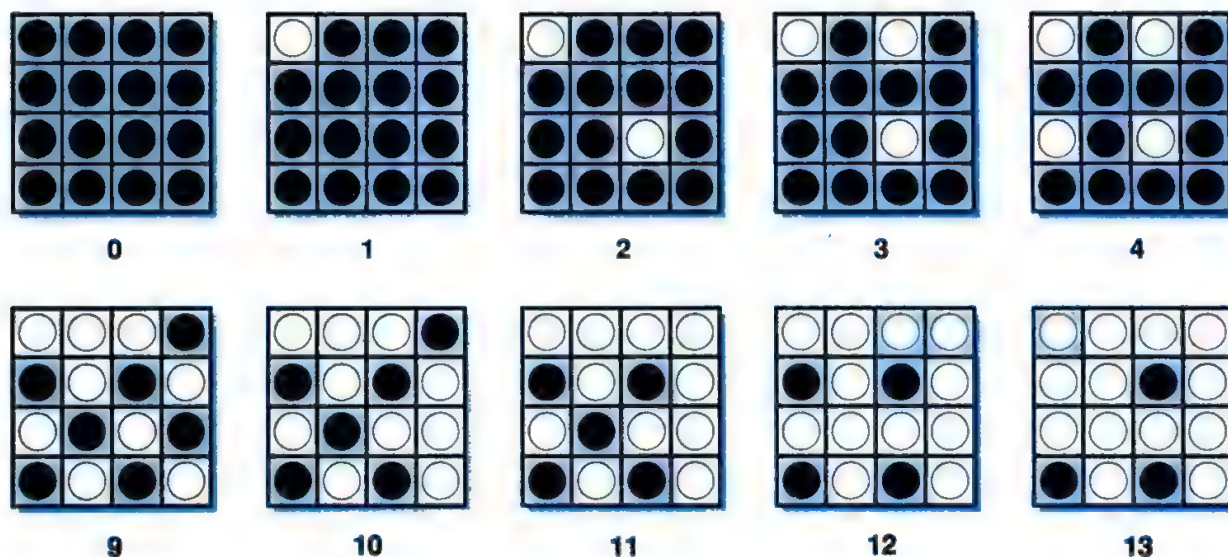
In the August 1991 Environments column ("Displaying Bitmap Images in Shades

of Gray"), I showed various renderings of a 256-color gray-shade DIB on an IBM 8514/A video adapter. This DIB was obtained by scanning a black-and-white photograph of *PC Magazine* associate editor Mary Kathleen Flynn with a Sharp JX-100 color scanner using the scanner's gray-shade mode. The color table of this DIB contains RGB color values with equal red, green, and blue intensities—from 00-00-00 (black) through FF-FF-FF (white). In that column I showed how to obtain good color accuracy by using the *Windows* palette manager to set the 8514/A palette with various uniform ranges of gray.

But as you are probably aware, the standard VGA device driver in *Windows* 3.0 doesn't support palette manipulation. And the palette for a 16-color VGA isn't set up to render a whole lot of gray shades. You get black, dark gray, light gray, and

Figure 1: On the left is a 256-color DIB displayed with the default 8514/A palette; on the right is a monochrome DIB using 16-level dithering.





white. Rendering this 256-color gray-shade DIB on a VGA requires the device driver to go through a nearest-color search to match the pixels of the DIB to the colors on the VGA. The image you get on a VGA uses only black, white, and the two gray shades. This gives the image a rather artsy chiaroscuro effect, but it's hardly an accurate rendition of the original photograph.

Even on an 8514/A, the default palette includes only 4 more colors beyond the standard 16 on the VGA. A couple of these extra colors are close enough to gray shades to fool the nearest-color algorithm, but the results don't look much better.

It is possible to increase the color accuracy of the image by reducing the number of colors to just black and white and using dithering. As proof that this works, take a look at Figure 1.

The original 256-color DIB displayed with the 8514/A video adapter's default palette is on the left. The monochrome dithered DIB is on the right. Although Figure 1 was captured from an 8514/A, the results are very similar to what you'd see on a VGA, except that on a VGA you wouldn't be able to see the whole bitmap at once.

I used a rather simple approach to creat-

ing the monochrome dithered DIB on the right. It's the same pixel width and height as the original 256-color DIB, but with 1 bit per pixel rather than 8. The color table contains the two RGB values 00-00-00 and FF-FF-FF. For each 4- by 4-pixel block in the original DIB, I averaged the 16 gray shade values and converted the result to a gray-shade level between 0 (black) and 16 (white). This value indicates the number of illuminated pixels in the corresponding 4- by 4-pixel block in the monochrome DIB.

Because dithering involves a pattern of black-and-white pixels, it's important to construct the pattern so that it provides a smooth and visually undistracting progression from one gray shade to the next. Figure 2 shows the 17 patterns I used for the dithered gray shades.

As you can see clearly, the dithered monochrome DIB in the right of Figure 1 more accurately conveys the gray shading of the original photograph; however, it still doesn't really compare with the version using actual gray pixels obtained

Figure 3: On the left is a 256-color DIB displayed using 16 gray shades; on the right is a monochrome DIB using 16-level dithering.



Environments

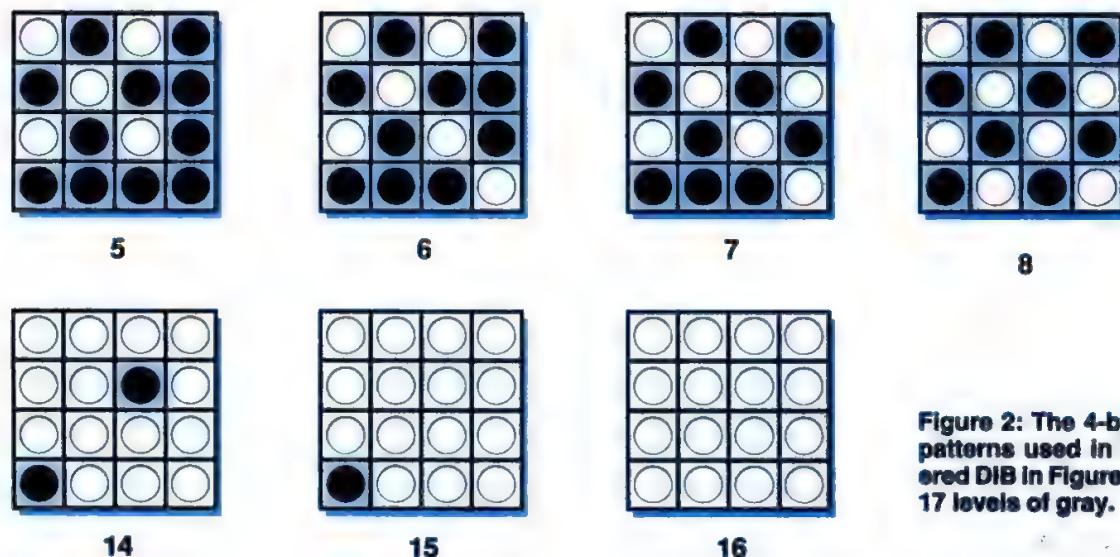


Figure 2: The 4-by-4 pixel patterns used in the dithered DIB in Figure 1 for the 17 levels of gray.

through manipulating the video palette, as Figure 3 demonstrates.

DITHERING IN COLOR

As you might expect, just as color complicates everything else in computer graphics, the introduction of color complicates dithering.

Color video displays themselves use a form of dithering for rendering color. If you look at a color display with a magnifying glass, you'll find that each pixel in

the display is composed of a red, green, and blue dot. In the standard default palette of a 16-color EGA and VGA, each of these three dots can be either black, half-illuminated, or fully illuminated. (It's actually a little more complicated than that, because a pixel cannot contain half-illuminated together with fully illuminated dots, and there's an additional gray shade involved.)

This suggested one simple approach to color dithering using only seven pixel

colors from the standard VGA palette—black, and the light and dark versions of red, green, and blue.

For the last Environments column, I created a 24-bit (full color) DIB by scanning a photograph of my nieces Erika and Alyssa. I discussed some different ways of rendering this DIB on a 256-color display using various algorithms for selecting a particular set of 256 colors and altering the 8514/A palette accordingly. I converted this 24-bit color DIB to a 16-color DIB using the dithering algorithm that is discussed below. The results are shown in Figure 4.

The DIB on the left is the original 24-bit DIB rendered with the default 8514/A palette; on the right is the 16-color DIB that was rendered with dithering. Although these DIBs are shown displayed on an 8514/A, the images are very similar to what you'd see on a standard 16-color VGA; however, you wouldn't be able to see the whole bitmap at once.

The dithering algorithm I used to convert the 24-bit color DIB to a 16-color DIB is as follows:

- Create a 16-color (4 bits per pixel) DIB with the same pixel width and height as the original 24-bit color DIB. Set the first seven RGB values in the DIB color table to 00-00-00 (black), 80-00-00 (dark



Figure 4: On the left is a 24-bit color DIB displayed with the default 8514/A palette; on the right is a 16-color DIB, but using only 7 colors with dithering.

Environments

red), FF-00-00 (light red), 00-80-00 (dark green), 00-FF-00 (light green), 00-00-80 (dark blue), and 00-00-FF (light blue).

■ For each pixel in the 16-color DIB, add the row and column values and divide by 3. If the remainder is 0, it will be a red pixel; if 1, a green pixel; if 2, a blue pixel. (For example, suppose the pixel is in row 5 and column 3. The sum of 5 and 3 is 8. Divide by 3. The remainder is 2. That will be a blue pixel.)

■ For each pixel in the 16-color DIB, look at the corresponding pixel in the 24-bit DIB and the 8 pixels that surround it. Average these 9 red, green, or blue values, depending on what color the resultant pixel will be as determined in the second step.

■ If the averaged color value is less than 0x55, set the pixel in the 16-color DIB to black (that is, an index of 0). If the averaged value is greater than or equal to 0x55 but less than 0xAA, set the pixel in the 16-color DIB to a dark color value. (For a red pixel, this will be an index of 1; for green, 3; for blue, 5.) If the averaged value is greater than or equal to 0xAA, set the pixel in the 16-color DIB to a light color value (for red, 2; for green, 4; for blue, 6).

This is the simplest color dithering algorithm I could come up with. Anything with all 16 colors in the standard VGA palette seemed much more complex.

Although the dithered 16-color DIB in Figure 4 certainly has more accurate flesh tones than the 24-bit color DIB using the

default palette, again it can't compare with a custom 256-color palette, as illustrated in Figure 5.

PALETTES, DITHERING, AND HALFTONES

I'm curious to see the four screenshots here reproduced in the magazine when this column is printed. I suspect I'll see

Whenever a dithered image is converted to a halftone image, strange things can happen. But this should not be the case. Color should be predictable and not dependent on the particular rendering technology.

things I don't see on the video display.

We've examined in this column (and the past couple of columns) two different approaches to rendering gray-shade and color bitmaps on video displays. One approach involves manipulating the video palette to get as many colors as possible

from the video adapter. The other approach uses a very limited number of colors with dithering.

When I look at the screen shot in Figure 3 on the 8514/A, I don't see exactly the same image. In particular, the custom-palette DIB on the left shows hair that is almost uniformly black, while the dithered DIB on the right shows some areas of hair (particularly towards the upper back) that are quite light. The hair in the original photograph is somewhere between these two extremes. Why the difference? I suspect it's due to nonlinearities in the rendering of color on a video display that I discussed in my April 30, 1991, column on gamma correction. A gray-shade RGB color value of 20-20-20 looks almost black on the 8514 video display, yet with 17-level dithering, one eighth of the pixels are white. Visually, this produces a lighter gray. (Supposedly the colors that my scanner outputs are gamma-corrected for video displays, but I have my doubts.)

Furthermore, when I look at Figure 5 on the 8514/A, I see a big difference in the color of the baby's outfit and the blanket. In the custom-palette DIB on the left, they look almost white. In the dithered DIB on the right, they look gray, even though the area is composed of light red, light green, and light blue pixels. In the original photograph, both the outfit and the blanket are a very light pink.

In magazines and newspapers, photographic images are rendered using *halftones*. With halftones, a gray-shade image is composed of equally spaced black dots. The size of the dot corresponds to the level of black. A color image uses four overlapping halftone patterns for cyan, magenta, yellow, and black.

I suspect that the custom-palette DIBs in Figures 3 and 5 will look more accurate in the magazine than on the video display, as halftoning should minimize the nonlinearities experienced with video.

How the dithered DIBs will look is anyone's guess. Strange things can happen when a dithered image is converted to a halftone image. The pixels and dots can interfere with each other, creating moiré patterns.

Once again, these problems indicate a need for a truly device-independent way of specifying color. I don't know how these images will look when they're printed in the magazine, and that should not be the case. Color should be predictable and not dependent on the particular rendering technology.



Figure 5: On the left is a 24-bit color DIB displayed with a custom 256-color palette using the "median cut" algorithm; on the right is a 16-color DIB, but using only 7 colors with dithering.

by
Ray Duncan

Power Programming

As you're probably tired of hearing by now, the three hallmarks of object-oriented programming languages (OOPLs) are encapsulation, inheritance, and polymorphism. In the last column, I introduced you to C++'s support for encapsulation of data and code inside classes and objects using the `struct`, `union{}`, `class{}`, `private`, `protected`, and `public` keywords. Here, we'll review C data types and C++ encapsulation briefly before moving on to discuss C++'s implementation of inheritance.

DATA STRUCTURES IN C

In C, new data types are built out of existing data types with the `struct {}` keyword. For example, you could create a new `POINT` data type whose member variables specified a point's location with a declaration in the following form:

```
struct POINT {  
    int X;  
    int Y;  
};
```

You'd then *instantiate* the data type—that is, allocate named storage for some points using the `struct {}` declaration as a template—with statements in the form

```
struct POINT pointA, pointB;
```

Such data declarations follow the usual C scoping rules. If a declaration is outside of any procedure, the data is allocated statically in the data segment and can be accessed by all procedures in that module. On the other hand, if a declaration is inside a procedure, the data is allocated on the stack and is "visible" by name only within that procedure (although the data can, of course, be passed as a parameter in calls to other procedures).

The C support for structures has two serious weaknesses. First, the language is not truly extensible: you can't declare totally novel data types; you can only build new data types out of C's "hard-

Implementing Encapsulation and Inheritance in C++

■ C++'s support for subclassing is primitive—there's no smart programming environment that understands and maintains the class hierarchy.

wired" native data types. Second, there is no provision for overloading the language's native operators to handle new `struct {}` data types in a natural manner. Both of these weaknesses have been answered in various ways by features of C++.

ENCAPSULATION IN C++

C++ classes are declared much like structures. In fact, the `struct {}` keyword still exists in C++, but has been made much more powerful, and it has two sister keywords—`union {}` and `class {}`—which have the same syntax but slightly different semantics. A C++ class includes both variables and the functions that operate on those variables in the same declaration. For example, we could define a C++ class `POINT`, which would include both a point's location and a "member function" to set the location:

```
// definition of class POINT  
struct POINT {  
    int X;  
    int Y;  
    void setXY( ... ) ...  
};
```

Actually, the member function can be coded either in-line, like this:

```
// definition of class POINT  
struct POINT {  
    int X;  
    int Y;  
    // member function to set  
    // point location  
    void setXY(int NewX, int NewY)  
    {  
        X = NewX;  
        Y = NewY;  
    }  
};
```

Or, it can be coded "out-of-line," in the form

```
// definition of class POINT  
struct POINT {  
    int X;  
    int Y;  
    void setXY(int, int);  
};  
  
// member function to set point  
// location  
void POINT::setXY(int NewX, int  
NewY);  
{  
    X = NewX;  
    Y = NewY;  
};
```

The selection of in-line or out-of-line declaration affects the compiler's compilation of the code for the function as in-line code (like a macro expansion) or a called procedure. Notice the C++ scoping

Power Programming

operator—the double-colon (::)—in the out-of-line form. The POINT modifier and the scoping operator in the definition of setXY() remind the compiler that the visibility of setXY() is determined by the class POINT to which it belongs, and that setXY()'s access to member variables and member functions is the same as the access enjoyed by other members of the POINT class.

Either way, once the POINT class is defined, we can instantiate a point object—allocate named storage for a point—and set the point's location with code like this:

```
POINT pointA;  
pointA.setXY(5, 10);
```

In this case, the dot (.) operator is a member function pointer; it tells the compiler to invoke the function named setXY() in the class to which the object pointA belongs. Thus, dot is somewhat analogous to the C language's -> operator for addressing member variables in C structures.

Let's return to the encapsulation angle for a moment. The member variables and functions of a C++ class can each have one of three possible attributes: public, protected, or private. A *public* variable or function is accessible by functions elsewhere in the program according to ordinary C-like scoping constraints. *Protected* means that the variable or function is visible only to other members of the same class, or to members of derived (child) classes (we'll return to this shortly when we get to the subject of inheritance). A *private* variable or function is completely invisible outside the class.

We're now in a better position to understand how the class declaration keywords struct{}, union{}, and class{} differ. They have identical syntax, but slightly different effects with regard to encapsulation:

- The member variables and functions of a struct{} are public by default, but can be made protected or private as needed.
- The members of a union{} are all public, all the time.
- The members of a class{} are private by default but can be made public or protected as needed.

Our POINT class example seems to

work well enough at first glance, but it's severely out of line with the OOP encapsulation dogma. In true object-oriented programming, objects are supposed to be black boxes, and their data is never visible externally. Objects can only operate on each other's data indirectly, by sending "messages" to each other's member functions. In order to become theologically correct, we can use the class{}

The means of making
class relationships and
the visibility of
functions explicit in
C++ are bound up in a
cryptic syntax that
rockets C's reputation
for unreadability into a
whole new dimension.

and public keywords to revise the definition of POINT as follows:

```
// definition of class POINT  
class POINT {  
    int X;  
    int Y;  
public:  
    void setXY(int, int);  
};  
  
// member function to set point  
location  
void POINT::setXY(int NewX, int  
NewY)  
{  
    X = NewX;  
    Y = NewY;  
};
```

Any instantiations of this version of the POINT class are true objects in the classic sense. Each object has its own copies of the member variables X and Y (hence the term *instance variables*). The member variables are private (because that is the class{} default), so they can only be accessed by member functions of

the same class. In contrast, the member function setXY() has been given the **public** attribute, so it can be called from anywhere in the program, limited only by the usual visibility rules. As a result, an external procedure has only one way to modify the values of X and Y in a POINT object: invoking (sending a message to) the POINT class's setXY() function.

INHERITANCE IN C++

We're now well positioned to talk about C++ inheritance. I'll keep the examples simple, but don't feel bad if you find the notation obscure—C++'s support for subclassing is as primitive as all of its other object-oriented features. In Smalltalk, encapsulation and inheritance are built into the programming environment as well as into the programming language: subclassing is supported by code browsers and inspectors that display the relationships between classes graphically and directly and facilitate the cloning, extension, and modification of class functions and variables in a very natural way. In C++, there is no programming environment that is "smart" about the programming language, and the burden of understanding and maintaining the class hierarchy is shifted entirely to the programmer. The relationships among classes and the visibility of class functions and variables must be made explicit on every occasion, and the means of doing so are bound up in a cryptic syntax that rockets C's reputation for unreadability into a whole new dimension.

A new class is derived from an existing class in C++ with a construct in the following general form:

```
class ParentClass {  
    ...  
};  
  
class ChildClass : [access]  
    ParentClass {  
    ...  
};
```

As you can see, when the child class is defined, its name is followed by a colon (:) separator and then by an optional *access modifier* and the name of the parent or *base* class. The access modifier determines the visibility of inherited variables and functions to users or descendants of the child class—in other words, what access rights will be passed on by the child class—it does not have any effect on the attrib-

Power Programming

POINT.H

COMPLETE LISTING

```
// POINT.H -- Class definition for points and pixels.
// Member functions are defined in POINT.CPP
// Copyright (C) 1991 Ziff Davis Communications
// PC Magazine * Ray Duncan

// definition of base class POINT
class POINT {
private:
    double X;           // X coordinate for point
    double Y;           // Y coordinate for point
    double deg2rad(double); // convert degrees to radians
    double rad2deg(double); // convert radians to degrees
public:
    POINT(double, double); // constructor for point
    void setX(double);      // set point value of X
    void setY(double);      // set point value of Y
    double getX(void);      // return point value of X
    double getY(void);      // return point value of Y
    void translate(double, double); // translate point by X,Y
    void rotate(double);    // rotate point by X,Y
};

// definition of derived class PIXEL
class PIXEL : public POINT {
    int Color;           // pixel color value
public:
    PIXEL(double, double, int); // constructor for pixel
    void setColor(int);        // set color of pixel
    int getColor(void);        // return color of pixel
    void display(void);        // display data for pixel
};

const double pi = 3.141592654; // constant Pi
```



```
// member function to set point
location
void POINT::setXY(int NewX, int
NewY)
{
    X = NewX;
    Y = NewY;
};

// definition of derived class
PIXEL
class PIXEL : public POINT {
    int Color;
public:
    void setColor(int);
};

// member function to set pixel
color
void PIXEL::setColor(int NewColor)
{
    Color = NewColor;
};
```

We can instantiate some pixels:

```
PIXEL pixelA, pixelB;
```

and then set their locations and colors:

```
pixelA.setXY(20,100);
pixelA.setColor(1);
```

Figure 1: This header file shows a class definition for two-dimensional points.

utes that were assigned in the parent class. If the access modifier is `private`, any variables and functions inherited from the parent become invisible to users of the child class, regardless of their original attribute. If the access modifier is `public`, the visibility of inherited variables and functions is determined by their original attribute as declared in the parent class. The default access modifier for child classes defined with `class{} is private`, and the default for those defined with `struct{} is public`.

Let's look at a simple example of inheritance. Imagine that we have all the code for our POINT class safely debugged, compiled, and stowed away in a library, and then find ourselves involved in a graphics project where we need a class of PIXEL objects, each with a location and a color. If we were still programming in C, we'd have to resort to frighteningly low-level mechanisms of code reuse: We'd copy the files containing the POINT source code to new files with different names, edit the code until it approximated our new requirements, and then enter the traditional compile-link-debug cycle. Of course, the mere fact that we decided to

turn an editor loose on previously proven source code means that we'd have all sorts of opportunities to introduce syntax or spelling errors that are completely tangential to the problem at hand, let alone the usual logical errors of omission or commission.

In C++, on the other hand, we can reuse our existing POINT code in a much more elegant manner. We create a PIXEL class by subclassing the POINT class directly, allowing the new class to inherit as much code and data from the old class as possible, and writing additional code only for the capabilities that differentiate the new class from the old. For example, to create a PIXEL class that uses the location data of the POINT class and adds a member variable for color along with a function to set its value, we could derive the PIXEL class as follows:

```
// definition of base class POINT
class POINT {
    int X;
    int Y;
public:
    void setXY(int, int);
};
```

From the point of view of the user of the PIXEL class, the fact that `setXY()` was actually defined in an ancestor class (along with the variables X and Y that it operates on) is completely transparent. The user of the PIXEL class concerns himself only with the capabilities exported by the PIXEL class and not whether those capabilities are inherent in the class or inherited from another class; he really doesn't need to know where the actual work is occurring or the actual location where the pixel is being stored.

There are many possible variations on this theme, depending on how you decide to assign access rights in the parent and child classes. For instance, if we wanted to create a member function in the PIXEL class that would set a pixel's location and color in a single operation, we could write

```
// definition of derived class
PIXEL
class PIXEL : public POINT {
    int Color;
public:
    void setPixel(int, int, int);
};
```

POINT.CPP

COMPLETE LISTING

```
// POINT.CPP
// Definitions of Member Functions for Point and Pixel Classes
// Copyright (C) 1991 Ziff Davis Communications
// PC Magazine * Ray Duncan

#include <math.h>
#include <iostream.h>
#include "point.h"

// Member function for POINT class to set X coordinate
void POINT::setX(double NewX)
{
    X = NewX;
}

// Member function for POINT class to set Y coordinate
void POINT::setY(double NewY)
{
    Y = NewY;
}

// Member function for POINT class to fetch X coordinate
double POINT::getX(void)
{
    return(X);
}

// Member function for POINT class to fetch Y coordinate
double POINT::getY(void)
{
    return(Y);
}

// Constructor function for POINT class
POINT::POINT (double NewX, double NewY)
{
    X = NewX;
    Y = NewY;
}

// member function for POINT class to translate point by given X,Y
void POINT::translate(double DispX, double DispY)
{
    X = X + DispX;
    Y = Y + DispY;
}

// member function for POINT class to rotate point by given degrees
void POINT::rotate(double degrees)
{
    double radians = deg2rad(degrees);
    double tempX = (X * cos(radians)) - (Y * sin(radians));

    Y = (X * sin(radians)) + (Y * cos(radians));
    X = tempX;
}

// private member function for POINT class to convert degrees to radians
double POINT::deg2rad(double degrees)
{
    return ((degrees * 2 * pi)/360);
}

// private member function for POINT class to convert radians to degrees
double POINT::rad2deg(double radians)
{
    return ((radians * 360)/(2 * pi));
}

// Member function for PIXEL class to set color
void PIXEL::setColor(int NewColor)
{
    Color = NewColor;
}

// Member function for PIXEL class to fetch color
int PIXEL::getColor(void)
{
    return(Color);
}

// Member function for PIXEL class to display location and color
void PIXEL::display(void)
{
    cout << " X = " << getX();
    cout << " Y = " << getY();
    cout << " Color = " << getColor();
}

// Constructor function for PIXEL class
PIXEL::PIXEL (double NewX, double NewY, int NewColor) : POINT (NewX, NewY)
{
    Color = NewColor;
}
```



Figure 2: This listing contains the member functions for the two-dimensional POINT class. The class supports getting and setting the point location, displaying the point location, and translating or rotating points.

```
// member function to set pixel
location and color
void PIXEL::setPixel(int NewX, int
NewY, int NewColor)
{
    setXY(NewX, NewY);
    Color = NewColor;
};
```

This is probably the "cleanest" approach, but the nested function calls slow it down. For better performance, we could rewrite the POINT class definition with the protected keyword to make its member variables available to descendant classes, then have setPixel() assign new values to X and Y directly:

```
// definition of base class POINT
class POINT {
protected:
    int X;
    int Y;
public:
    void setXY(int, int);
};
```

```
// definition of derived class
PIXEL
class PIXEL : public POINT {
    int Color;
public:
    void setPixel(int, int, int);
};
```

```
// member function to set pixel
location and color
void PIXEL::setPixel(int NewX, int
NewY, int NewColor)
{
    X = NewX;
    Y = NewY;
    Color = NewColor;
};
```

CONSTRUCTORS AND DESTRUCTORS

Constructors and destructors are basic to object-oriented programming languages and confer great power when properly used. Though the terms sound rather arcane and are reminiscent of Saturday morning cartoons, they're actually pretty simple to understand. Basically, every class has special constructor and destructor member func-

tions. The constructor function is called each time the class is instantiated to make a new object, and the destructor function is called whenever an object is destroyed (for example, when a function that instantiated the object in "automatic" storage on the stack terminates, and its stack frame is destroyed).

We've been able to ignore the existence of constructors and destructors until now because C++ provides default constructors and destructors for every class. The default constructor allocates sufficient storage to hold the object's member variables and initializes those variables to zero, and the default destructor merely deallocates the storage that was previously allocated by the constructor.

There will be many cases, however, where we'll want to write our own constructor and destructor functions. For example, we may want to give member variables nonzero initial values or to carry out other, more-complex operations when an object is created or destroyed. The syntax for writing a C++ constructor function is quite straightforward: You just declare

Power Programming

TRYPOINT.CPP

COMPLETE LISTING

```

// TRYPOINT.CPP - Try Point and Pixel Classes
// Compile with Borland C++ 2.0
// Copyright (C) 1991 Ziff Davis Communications
// PC Magazine * Ray Duncan May 1991

#include <iostream.h>
#include "point.h"

main()
{
    int tempX, tempY, tempColor;           // scratch variables
    double degrees;

    PIXEL myPixel(0,0,0);

    cout << "\nEnter X coordinate: ";      // prompt for pixel
    cin >> tempX;                          // location and color
    cout << "Enter Y coordinate: ";
    cin >> tempY;
    cout << "Enter pixel color: ";
    cin >> tempColor;

    myPixel.setX(tempX);                  // set pixel value
    myPixel.setY(tempY);
    myPixel.setColor(tempColor);

    cout << "\nEnter X translation: ";      // prompt for pixel
    cin >> tempX;                          // translation and
    cout << "Enter Y translation: ";        // rotation
    cin >> tempY;
    cout << "Enter rotation (deg): ";
    cin >> degrees;

    myPixel.translate(tempX, tempY);      // now apply translation
    myPixel.rotate(degrees);              // and rotation factors

    cout << "\nNew value of pixel: ";      // display new pixel values
    myPixel.display();
}

```

Figure 3: This demonstration program can be linked with POINT.H and POINT.CPP. It prompts you for a pixel location, pixel color, translation distance in the X and Y axes, and number of degrees of rotation, and then displays the resulting point location. The code in Figures 1 through 3 has been tested with Borland C++, Version 2.0.

a member function whose name is exactly the same as the class's name. Suppose we wanted to change our POINT and PIXEL classes so we could assign a location and color when a PIXEL was created, without the need for an additional call to the setPixel() function. We'd add constructor functions to our class definitions as follows:

```

// definition of class POINT
class POINT {
protected:
    int X;
    int Y;
public:
    POINT(int, int)
    void setXY(int, int);
};

// constructor for class POINT

```

```

POINT::POINT (int NewX, int NewY)
{
    X = NewX;
    Y = NewY;
};

// definition of class PIXEL
class PIXEL : public POINT {
    int Color;
public:
    PIXEL(int, int);
    void setPixel(int, int, int);
};

// constructor for class PIXEL
PIXEL::PIXEL (int NewX, int NewY,
               int NewColor)
    : POINT (NewX, NewY)
{
    Color = NewColor;
};

```

Once the constructors are installed in our class definitions, we can instantiate a PIXEL with an initial location of (X,Y)=(-1,-1) and Color=7 like this:

```
PIXEL pixelB(-1, -1, 7);
```

Notice that the constructor for PIXEL invokes the constructor for the ancestor class POINT before carrying out its own actions. In fact, this happens whether you want it to or not: C++ always calls the constructors of all the predecessor classes before calling the constructor for a derived class; this way all inherited variables are properly allocated and initialized when the derived class's constructor starts running. Writing out the call to the constructor explicitly, however, gives you the chance to pass specific values. Also, observe that constructor functions do not have a return type. This is always the case—it's one of the ways that the compiler identifies the definition as a constructor.

Destructor member functions are defined in much the same way as constructors, except that the name of a destructor is always the same as the name of the class with a preceding tilde character (~), for example:

```

// destructor for class PIXEL
PIXEL::~PIXEL()
{
    ....
};

```

Destructor functions have neither a return type nor any parameters.

It's only fair to mention that C++ also allows you to declare special member functions to copy objects and to perform type conversions on member variables, but we'll leave these subjects for another time.

Figures 1 through 3 contain a more complete version of the POINTS and PIXEL classes in the form of a header file, a module containing definitions of the class's member functions, and a demonstration program. This source code is compatible with Borland C++, Version 2.0.

THE IN-BOX

Please send your questions, comments, and suggestions to me at any of the following e-mail addresses:

PC MagNet: 72241,52

MCI Mail: rduncan

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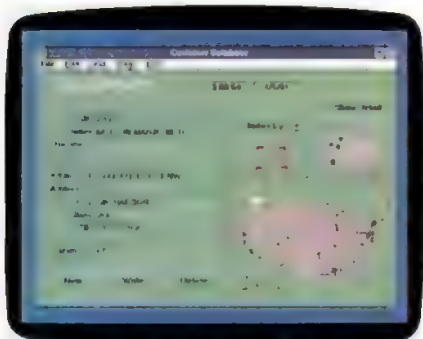
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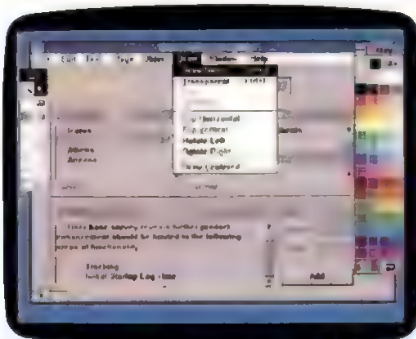
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by
Fran Finnegan

Windows

QUICK FLOPPY FILE LISTINGS

In previous Windows columns, you've mentioned that the MS-DOS Executive (MSDOS.EXE) can be used with *Windows* 3.0. This is a boon for me, because if I want only a simple file listing of a floppy disk, I don't have to run the File Manager and do a number of keystrokes or mouse clicks to get it. Instead, all I have to do is bring up the MS-DOS Executive from Program Manager and I immediately have a file list. Even though the MS-DOS Executive displays a file list, you still have to click on the A: icon or hit Control+A in order to change drives.

Another reader's suggestion points out that it is possible to put an "incorrect" path on a Program Manager program item's Command Line to start an application with a default directory other than the current directory. For example, C:\WORK\STUFF\EXCEL.EXE will start *Microsoft Excel* with C:\WORK\STUFF as the current working directory, even though EXCEL.EXE may be in the C:\EXCEL directory. (Note: C:\EXCEL must be in your PATH statement in AUTOEXEC.BAT for this to work.)

Both of these ideas can be combined to obtain a quick listing of the contents of a floppy disk *without* using any additional keystrokes.

Just use the Program Manager to create a new program item. In the Program Item Properties dialog box, enter the Description as A:\ or something similar. Now enter the Command Line as

a:\msdos.exe

for the MS-DOS Executive, starting it with a current directory of A:\. You will get an "Invalid Path" warning, so click OK to continue. You will get a second warning, "Removable Path Specified," so click on Yes to continue. You will now have a new Program Manager icon.

When you click on this new icon, *Windows* will look for the MS-DOS Executive on the A: drive first, then it will look on the

■ **QUICK FLOPPY FILE LISTINGS:** Combining the MS-DOS Executive with a *Windows* trick gets file listings quickly.

■ **GENERATING 256 OR MORE PURE COLORS:** Have you ever wondered why you still get dithering on your 256-color board?

PATH. Of course, C:\WINDOWS or the directory that MSDOS.EXE is in has to be in your PATH environment variable. If so, a quick listing of the A: drive will be displayed. *Windows* will warn you if you accidentally click on the icon without a disk in the drive.

Cam Larson
Torrance, California

 If you are primarily a Program Manager user, this is indeed a useful trick to get a quick listing of the diskette in A:. I've found it useful enough to add it to one of my Program Manager groups.

The concept can be extended to any other drive or subdirectory, for that matter. All things considered, it's faster than having to type DIR A: at a DOS prompt, since all you have to do is double-click on an icon. And you get a file listing that is scrollable, which the regular DOS shell does not give you.

If you don't want to set up a separate Program Manager program item icon, you can accomplish the same thing by executing the File Run command and entering

a:\msdos

at the Command Line.

GENERATING 256 OR MORE PURE COLORS

I have recently upgraded from a standard VGA system to a Super VGA board that's supposed to give me 256 colors in 640-by-480 mode. I know the driver and board are properly installed because Setup confirms that they're running. But when I glance at the screen, it looks as though I'm still running in standard VGA. When I run the Control Panel's Color command, I can get hundreds of dithered hues, but only 16 pure colors. What gives?

Joanna Davis
Greenburgh, New York



There may well be a groundswell of resentment when people realize that they're not getting 256 colors in *Microsoft Windows*, even though they've paid extra for a 256-color graphics board. Ideally, you should be able to plug in a 256-color board and not have to worry about whether your software can truly use the extra color capability; today, however, that's not the case. Having display hardware and drivers *capable* of simultaneously generating 256 or more pure (nondithered) colors does not necessarily mean that you will *actually* be able to display them in *Windows* 3.0.

Microsoft has specified and implemented a new palette-based management concept and subsystem within *Windows*. (In *Windows*, palette-based means 256 or more colors.) However, by default, the system provides only 20 pure colors to applications; other colors are created by dithering. The only way to get more than the 20 default colors is to use applications written *specifically* to take advantage of the new palette manager. Currently, few applications use the palette manager—not even the Control Panel.

Actually, the Control Panel offers the easiest and most graphic application in which to illustrate the problem: Execute the Color command, choose Color Palette, and select Define Custom Colors. The Custom Color Selector dialog box

Windows

will open up and present a large "color surface" on which gradations of color are spread. Using this large square and the smaller Color/Solid box, you can generate a wide range of colors, all but 20 of which will be dithered.

What you see on the screen is the result of the interaction among the application, *Windows*, the display driver software, the adapter board, and the monitor. There is a hierarchical relationship that exists between each of these components of your system. Each component in essence talks to the next component. All the dithering exists because Control Panel does *not* talk to the palette manager. Nor do any of the other Microsoft applications that come with *Windows*, such as Paintbrush.

Why did Microsoft implement palette management this way? Because the developer felt that it was important for a single application to have complete control. *Windows* is a multitasking environment, and several applications might want to control the entire palette at once. Microsoft, therefore, had to make a technical decision: Should all applications share a single, constant, systemwide 256-color palette and have *no* control over it, or should a single application have *complete* control over changing the system palette when it is the currently active (top-most) application? Microsoft decided to go with the latter alternative and implemented the control mechanism for it in the palette manager. With this implementation, the active application would have to communicate with the palette manager to change the system palette *and* other applications would have to be notified so that they could react to the new palette. Unfortunately, allocating control to the currently active application has the side effect of eliminating the possibility of a constant, systemwide 256-color palette that applications could use by default.

To ensure that *some* basic colors exist for applications that don't use the palette manager—even if another application changes the system palette via the palette manager—Microsoft set aside 20 colors that are guaranteed to be available to applications. So you will see only these 20 colors *unless* your applications make the extra effort to use more color. Even though *Windows* 3.0 has been available for over a year, few applications make the

Palette	Default palette index	256-color index	RGB Value			Color	Usage
Lowest 10	[0]	[0]	0	0	0	Black	VGA-standard
	[1]	[1]	128	0	0	Dark red	
	[2]	[2]	0	128	0	Dark green	
	[3]	[3]	128	128	0	Pea green	
	[4]	[4]	0	0	128	Dark blue	
	[5]	[5]	128	0	128	Lavender	
	[6]	[6]	0	128	128	Slate	
	[7]	[7]	192	192	192	Light gray	
	[8]	[8]	192	220	192	Pale green	
	[9]	[9]	166	202	240	Pale blue	
Highest 10	[10]	[246]	255	251	240	Off white	Special purpose
	[11]	[247]	160	160	164	Medium gray	
	[12]	[248]	128	128	128	Dark gray	VGA-standard
	[13]	[249]	255	0	0	Bright red	
	[14]	[250]	0	255	0	Bright green	
	[15]	[251]	255	255	0	Yellow	
	[16]	[252]	0	0	255	Bright blue	
	[17]	[253]	255	0	255	Magenta	
	[18]	[254]	0	255	255	Cyan	
	[19]	[255]	255	255	255	White	

* Some display drivers implement Pale blue as RGB 164 200 240.

Figure 1: The *Windows* 3.0 default palette, as specified by Microsoft for display driver writers, is made up of 20 entries representing basic *Windows* colors.

effort because it's extra work for their developers. As a result, users end up getting a default palette and a lot of dithering.

The dithering itself is created by alternating pixels of colors chosen from the default palette. The default palette's 20 stock colors are shown in Figure 1. The palette manager specification calls for these colors to be the first ten and the last ten in the device driver's list of palette colors. (If you run on a VGA driver, you get the first eight and the last eight colors of the default palette, even though your system is not considered to be palette-based.) The remaining 236 colors (256 less these 20) are free to be changed by applications that use the palette manager. (Technically, an application can also change 18 of the default 20 if it absolutely has to.) The 236 are within the range of so-called *special-purpose* colors. If an application does not use the palette manager, the display driver maps all color requests to one of the 20 (or 16, for VGA) colors, or provides dithering. It is frustrating to think that you would get a dithered color even if a pure equivalent existed elsewhere in the system palette, just because your application is not coded to use the palette manager!

Moreover, to add insult to injury, the default palette is *supposed* to be the same for all display drivers (per Microsoft's

specification), but some display drivers deviate from the values shown. For example, Microsoft's own 8514/A display driver (8514.DRV) implements pale blue as RGB(164, 200, 240) instead of RGB(166, 202, 240), forcing other display driver writers to do the same if 8514/A compatibility is important to them. (Wouldn't the *Windows* world be nicer if Microsoft itself adhered to its purported standards!) You can use Control Panel's Custom Color Selector to see how your driver is implemented; one of these versions of pale blue will be pure and the other dithered.

At a minimum, you should add the Default Palette's middle four colors (pale green, pale blue, off-white, and medium gray) to your Control Panel list of Custom Colors, since they are not even in the group of 48 that Control Panel provides. If these colors are significant for some reason, why weren't they included in the list of 48 standard Control Panel colors? It doesn't make sense.

Does each application *have* to have the potential of changing the system palette? I don't think so. It may be perfectly acceptable to you if all your applications shared a single, constant, systemwide default palette of 256 colors. The key to circumventing the existing situation lies in the display driver. Although Microsoft

Windows

has asked device driver writers to adhere to the 20-color default palette, they don't have to.

Binar Graphics of San Rafael, California, for instance, is writing some *Windows* display drivers that provide more than the 20 default colors. These drivers apparently pretend to be non-palette-based, disabling any action of the palette manager. They then provide a complete palette of colors to *Windows* applications. With this solution, each application can request a color by default from the entire palette of 256 pure colors,

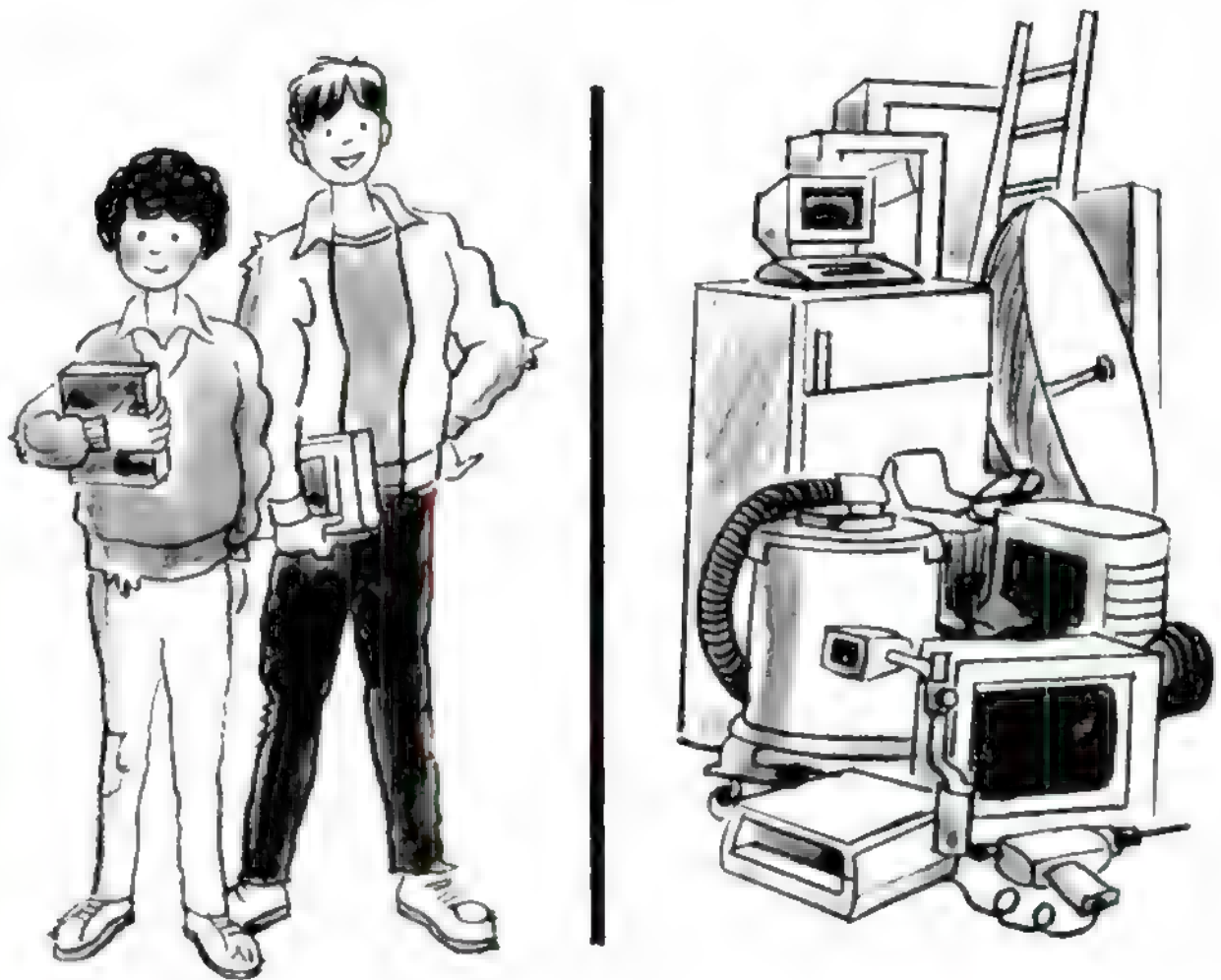
With new display drivers that pretend to be non-palette-based, applications can request a color by default from the entire palette of 256 colors.

and no application can use the palette manager to take over the palette and change it. (This isn't dangerous, since applications have to be written to work on non-palette-based devices, anyway.) This way you get a complete palette right out of the box, and you don't have to worry about whether your applications talk to the palette manager. The idea is doubly appealing because you could freely choose between this type of display driver or a palette-manager-based one.

OPENING WINDOWS

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by
Sal Ricciardi

Databases

PRINTING IN RANDOM ORDER

When formatting printer output, *Clipper* won't let you "back up" on a page to print to a previous row. If you try this using @...SAY, *Clipper* sends a form-feed to your printer.

Using the UDF shown in Figure 1, you can back up a row (or column) on a Hewlett-Packard LaserJet printer. The PUT function uses the LaserJet's Horizontal and Vertical Row and Column positioning commands: <Esc>&a#C (to position to column #) and <Esc>&a#R (to position to row #).

Kevin Owens
Kennesaw, Georgia



Mr. Owens's PUT function uses HP LaserJet escape sequences in order to position output on the printed page. Since the function uses rows and columns to position the output, it's best suited to use with fixed-pitch fonts. Another possible approach, one that uses *decipoints* instead of rows and columns, is also presented in this installment of *Databases* (for a detailed explanation please see the discussion of Mr. Miller's AT SAY

■ **PRINTING IN RANDOM ORDER:** Here's a *Clipper* technique that lets you "back up" on a page and print previous rows or columns to an HP LaserJet.

■ **PRINTING NUMBERS IN A PROPORTIONAL FONT:** Align columns of numbers printed to an HP LaserJet with this *FoxPro* UDF.

function in the following letter).

The TRYPUT demo program shown in Figure 1 uses PUT to output a page of "snaking-column" numbers. It prints the first column from top to bottom and then returns to the top to print the next column. The procedure demonstrates that you can use the LaserJet's own commands to back up on a printed page.

TRYPUT.PRG

COMPLETE LISTING

```
*****
* TRYPUT.PRG                               Clipper S87
* Sample program to demonstrate using the put function.
* Prints columns of numbers across the page.
*****
SET DEVICE TO PRINT
n = 0
FOR c = 1 TO 75 STEP 5      ** Column
  FOR r = 1 TO 65          ** Row (line)
    n = n + 1
    x = ALLTRIM(STR(n))
    PUT(r, c, x)
  NEXT
NEXT
SET DEVICE TO SCREEN
EJECT
RETURN

FUNCTION put
PARAMETER row, col, text
??? CHR(27)+'&a'+ALLTRIM(STR(col))+'C'+CHR(27)+'&a'+ALLTRIM(STR(row))+'R'+text
RETURN .t.
```



PRINTING NUMBERS IN A PROPORTIONAL FONT

I design reports that will be printed on a Hewlett-Packard LaserJet, and I've often been frustrated by the lack of proportional-font formatting options in *dBASE III* and *FoxPro*. When using proportional fonts, it's difficult to format columns of numbers and cumbersome to have to format a page in line-number order.

Using *FoxPro*, I developed a function that better supports the use of proportional fonts on the LaserJet. The AT SAY function, shown in Figure 2, will properly align columns on a page. It also lets you position output in any order desired. In other words, instead of being forced to program each line in order from top to bottom, you can have your program print an entire column and then return to the top of the page to start the next column.

The AT SAY function depends on two PUBLIC variables, *lpi* and *pitch*. Pitch is assigned a value that corresponds to the number of characters per inch (cpi) in a proportional font. *lpi* is assigned the number of lines per inch to print. The AT SAY function uses the *pitch* and *lpi* values to convert traditional @...SAY row and column coordinates to decipoints. The decipoints are then used in horizontal and vertical escape sequences. When these escape sequences are sent to the printer, they position the printer's cursor in the same location that would be used if a fixed-pitch font of the same point size were selected. These two variables must be assigned an appropriate value any time the font size is changed.

The function uses *FoxPro*'s ??? command to send the output string directly to the printer without carriage returns.

The AT SAY function is designed to accept either character or numeric output. It is called in the format

=AT SAY(row, col, data, [picture])

Figure 1: The PUT function and TRYPUT demo program show how you can "back up" to a previous row or column when printing to a Hewlett-Packard LaserJet printer.

The *row* and *column* variables do not have to be whole numbers, so features

Databases

like half-spacing are easily programmed.

With character output, the function uses escape codes to position the printer's cursor before printing the entire character string. With numeric output, a PICTURE clause should be passed with the parameters. The numeric data is TRANSFORMED using the PICTURE clause and stored as a character string. Then, using the SUBSTR function, ATSAY individually obtains, positions, and prints each character of the string using equal amounts of space. Since each character is individually positioned, rather than the string as a whole, the columns of numbers are forced to right-justify, and decimal points and commas to align properly.

Jeffrey S. Miller
Deerfield, Illinois



If you are designing reports for a Hewlett-Packard LaserJet printer, this function could come in handy. It lets you format a page in random order, plotting data anywhere you want, as long

ATSAY FUNCTION

COMPLETE LISTING

```
*****
* FUNCTION atsay
*
* Use HP LJ vertical and horizontal decipoint positioning to place
* character or numeric output on a page.
*
* Requires PUBLIC variables pitch and lpi.
*****
FUNCTION atsay
PARAMETERS mrow, mcol, fieldval, pictval

move_hor = ROUND(720/pitch, 2)      ** Relative horizontal move value
hor = 720/pitch * mcol              ** Horizontal position based on @ SAY value
ver = LTRIM(STR(720/lpi * mrow, 5, 2)) ** Vertical position based on @ SAY value

IF TYPE("pictval") = "C"             ** "L" if not provided
    fieldval = TRANSFORM(fieldval, pictval) ** Transform the number
    no_chars = LEN(fieldval)          ** Calculate length of field
    ??? CHR(27) + "&a" + LTRIM(STR(hor,5,2)) + "h" + ver + "v"
    *
    * Calculate rightmost character position
    *
    end_hor = hor + (move_hor * no_chars)
    *
    * Calculate leftmost character position allowing 98% of pitch value
    * for each character
    new_pos = end_hor - (move_hor * no_chars * .9)
    FOR char = 1 TO no_chars
        ??? CHR(27) + "&a" + LTRIM(STR(new_pos,5,2)) + "h" + SUBSTR(fieldval,char,1)
        new_pos = new_pos + (move_hor * .9) ** Calculate next character position
    ENDFOR
ELSE
    ??? CHR(27) + "&a" + LTRIM(STR(hor,5,2)) + "h" + ver + "v" + fieldval
ENDIF
RETURN ""
```



Figure 2: When printing to a Hewlett-Packard LaserJet printer, the ATSAY function makes it easy to line up columns of numbers in a proportional font.

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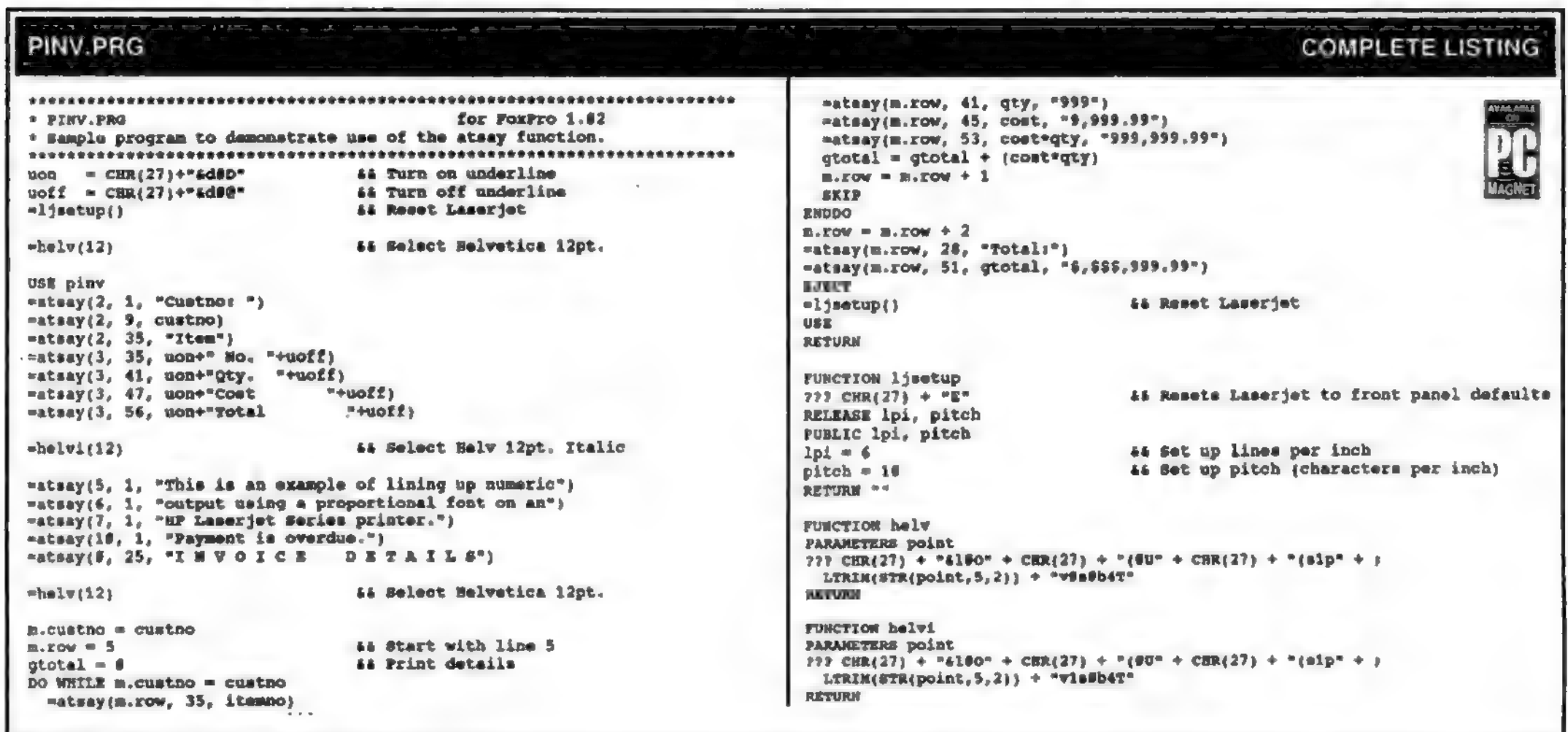


Figure 3: This program uses the AT SAY function in Figure 2 to print a sample invoice using a 12-point Helvetica font. Notice that output does not have to be sent to the printer in line number order.

as it's within a page's printable region. It also provides a useful technique for lining up columns of numbers using a proportional font.

Normally, it's a rather difficult task to align numbers properly using a proportional font. This is because each character in a proportional font is individually sized. The result of this individual sizing is that the characters wind up with different widths. Proportional fonts differ from their fixed-pitch cousins in that with the latter, every character in the set has exactly the same width.

The AT SAY function aligns numbers by making believe it is using a fixed-pitch font and positioning each character individually before printing. This means that each character position in a numeric column is exactly the same as the one underneath it. Since the calculation that determines the print position depends on the **pitch** and **lpi** settings, you'll have to select these carefully, and it may be necessary to experiment with them a little bit. A sample program that demonstrates the use of the AT SAY function is shown in Figure 3.

When using the AT SAY function to format columns of numbers, it's important to remember to pass the PICTURE clause. For example, for properly aligned numbers, use the following:

```
=ATSAY(m.row, 45, cost,
      "9,999.99")
```

and not

```
=ATSAY(m.row, 45, cost)
```

The function uses the presence of the PICTURE clause to determine whether to position and print each character individually.

The AT SAY function also makes it easy to format a page in random order. Normally, if you attempt to @...SAY printer output to a line that is less than the last one printed (trying to print to line 5 after you've already printed to line 10, for example), *FoxPro* sends a form-feed to the printer—as do most *dBASE* implementations. Using the AT SAY function, you can format a page layout in any order that you want, without harmful side effects.

According to the Hewlett-Packard *LaserJet Series II Printer Technical Reference Manual*, the printer's cursor can be positioned using several different techniques. Using decipoints to plot (which is the technique the AT SAY function uses) is among them; HP defines decipoints as 1/720 inch. The AT SAY function positions the printer's cursor by sending the printer Horizontal Cursor Positioning

commands and Vertical Cursor Positioning commands using the escape sequences defined by Hewlett-Packard.

Readers interested in investigating techniques for programming an HP LaserJet may want to consider purchasing one of the following technical reference manuals from Hewlett-Packard: *HP PCL5 Printer Language Technical Reference Manual*, which covers Laserjet Series III printers (\$37), or *HP Laserjet Series II Printer Technical Reference Manual* (\$19). These guides contain a wealth of valuable information and are available from Hewlett-Packard Direct; call 1-800-538-8787.

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by
Craig Stinson

Spreadsheets

AVOID NEEDLESS TEXT ENTRIES IN EXCEL

After using *Lotus 1-2-3* for many years, I have recently switched to *Microsoft Excel*. I'm generally happy with my new spreadsheet; however, I have one complaint. When you enter ZIP codes that start with 0, you can't type them as numbers, because *Excel* drops the first 0. To get around the limitation, you have to enter them as text, such as

"02134"

That's a lot of keystrokes to do the equivalent of

'02134

in *1-2-3*. Is there an easier way?

George Ameling
Chadron, Nebraska

 Yes, there is an easier way. You can define a custom numerical format for either five-digit or nine-digit ZIP codes. Start by selecting the cells in which you want to enter ZIP codes. Pull down the Format menu and choose Number. Then, in the dialog box, press Tab to select the Format line. On this line, type

00000

for five-digit ZIP codes, or

00000-0000

for nine-digit codes. Then press Enter or click the OK button. *Excel* will assign your new ZIP code format to the cells you selected when you started this procedure. It will also add the new format to the regular list of built-in numeric formats. This way, you can easily create other ZIP codes elsewhere on the same worksheet. To create another column of ZIP codes, select that column, choose the Format Number command again, and then scroll

■ **AVOID NEEDLESS TEXT ENTRIES IN EXCEL:**
You can save keystrokes by creating your own numeric formats.

■ **SOLVING ALGEBRAIC EQUATIONS IN EXCEL:**
Solver is not just for "what-if" problems. Use it to crack complex algebra problems that would take too much patience and paper to solve by hand.

■ **THE LASERJET III AND EXCEL 3.0:** If you have trouble printing in landscape mode, try an easy two-step workaround.

to the bottom of the list of built-in formats. Here you'll find your new ZIP code format. Select it, hit the OK button, and you're set.

The 0 character in a custom format specification indicates a required digit. If your format is 00000, for example, and you type the number 02134, *Excel* will display all five digits. Even if you type 2134, *Excel* will add a 0 on the left, so you'll still get 02134.

If you use this procedure instead of typing "02134", *Excel* will treat your ZIP codes as numeric entries, not as text. As long as you do this consistently within a block of cells, your ZIPs will sort just the way you expect; that is, 02134 will be sorted ahead of 10016, just as it would if you had entered them both as text. If you mix text-style ZIP codes with numeric entries, however, you'll have a problem. All the numeric entries will be sorted ahead of all the text entries.

The hyphen character in the nine-digit format specification causes *Excel* to enter a hyphen before the fourth digit from the right. For example, if you type the number 910061988, *Excel* will display 91006-1988. You should be careful with "automatic" hyphens, though. If you make a mistake and type the hyphen yourself, *Excel* will think you're entering a text label, not a number. The text entries will align left by default, and the numeric entries will align right; but if your column is exactly ten characters wide, you won't notice this difference. Consequently, everything may look the same on-screen, but the textual ZIPs won't be sorted correctly with the numeric ZIPs.

If you take the custom format approach to ZIP code entry, you'll need to re-create the new format on each worksheet that uses ZIP codes. If you find that burdensome, you can create a template worksheet on which your custom format is defined, then use that template as a starting point for each worksheet on which you plan to store addresses.

If you're using *Excel* 3.0, you can take advantage of a couple of new features that simplify the creation and use of templates. On a blank worksheet, define the custom formats you want to use. Then choose the File menu's Save As command, click the Options button, and save your file in *Excel*'s template format. You might want to name the file ZIP; *Excel* will automatically add the extension .XLT. Then, whenever you want to use the ZIP code format, open your template file. Recognizing that the file you're opening is a template, instead of a standard .XLS file, *Excel* will present you with a copy of ZIP.XLT, leaving the original on-disk. The title bar will say ZIP1 (with no extension), and you will be required to supply a new filename each time you save the file.

Moreover, if you store your ZIP template in a subdirectory named XLSTART, immediately subordinate to your *Excel* subdirectory, then you'll be able to open

Spreadsheets

a copy of your template by choosing the File New command. Normally, the File New command presents you with three file-type choices: worksheet, macro sheet, and chart. However, any template files that have been stored in the XLSTART directory will also appear in the File New command's dialog box.

Finally, the latest version of *Excel* offers yet another approach to ZIP code entry, one that may be of particular interest to those accustomed to 1-2-3's way of doing things: If you pull down the Options menu, choose Workspace, and then select the check box marked Alternate Navigation Keys, *Excel* 3.0 will allow you to enter numeric labels with 1-2-3-style prefix codes. For example, you'll be able to type

'01234

and *Excel* will give you a left-aligned text label that includes the 0. This option, which affects all files, not just the current worksheet, also makes the End key behave as it does in 1-2-3.

SOLVING ALGEBRAIC EQUATIONS IN EXCEL

Solver, a *Microsoft Excel* 3.0 add-in, is excellent for solving "what if" problems. But I've also found it useful for dealing with complex algebraic equations that have only one variable—equations that are not factorable and are too complex for the quadratic equation. For example, the fol-

lowing equation would require a great deal of manipulation to solve manually for x :

$$\frac{(3-2x)^2(1-x)}{(2x)^2} = 16$$

In *Excel*, however, this equation can be solved easily with only two cells. Assign to one cell—say, A2—the statement

$$=((3-(2*A1))^2*(1-A1))/(2*A1)^2$$

where A1 represents the variable x . In A1, enter a trial value—anything other than 0. Then, use the Formula Solver command to start Solver: Type \$A\$2 in the "Set Cell:" box, type 16 (the constant of the equation) in the "Value of:" box, and type \$A\$1 in the "By Changing Cells:" box. Figure 1 shows how this setup should look. Finally, press the Solve button.

When Solver has found the solution, it places the correct value of x , 0.264783, in cell A1.

Sherwin Aziz-Zadeh
Los Angeles, California



You can certainly use Solver to find which value of cell A1 produces a desired result in cell A2. But when you have only one input to consider, it's much simpler to use *Excel* 3.0's new Goal Seek command (on the Formula menu). With Goal Seek, you don't have to load an add-in, and the dialog box is simpler to fill out.

Goal Seek, like the Solver, uses an iterative technique to produce the desired

answer. By default, it stops when the difference in the results of successive iterations is less than 0.001. To get an exact answer, you may need to change this threshold. For example, in Mr. Aziz-Zadeh's problem, the default settings produce a target value of 15.99997 in cell A2. To get a result that *Excel* recognizes as the integer 16, you need to set the threshold to 0.00001. You can do this with the Options menu's Calculation command.

THE LASERJET III AND EXCEL 3.0

Excel 3.0 has a bug that prevents it from printing in landscape mode to a Hewlett-Packard LaserJet III. The workaround, I have learned, is as follows:

First, invoke the Printers section of *Microsoft Windows* 3.0's Control Panel and set your printer's resolution to 75 dots per inch. Then activate the *Excel* window, bring up your printer's Setup dialog box, and set the resolution back to 300 dpi. Everything works fine if you just follow these two steps.

Stuart Gilman
Irvine, California



Gilman is correct; there's a bug in *Windows*' HPPCL5 printer driver that affects the printing of *Excel* worksheets in landscape mode. The solution he describes adds the following line to your WIN.INI file:

prtresfac=0

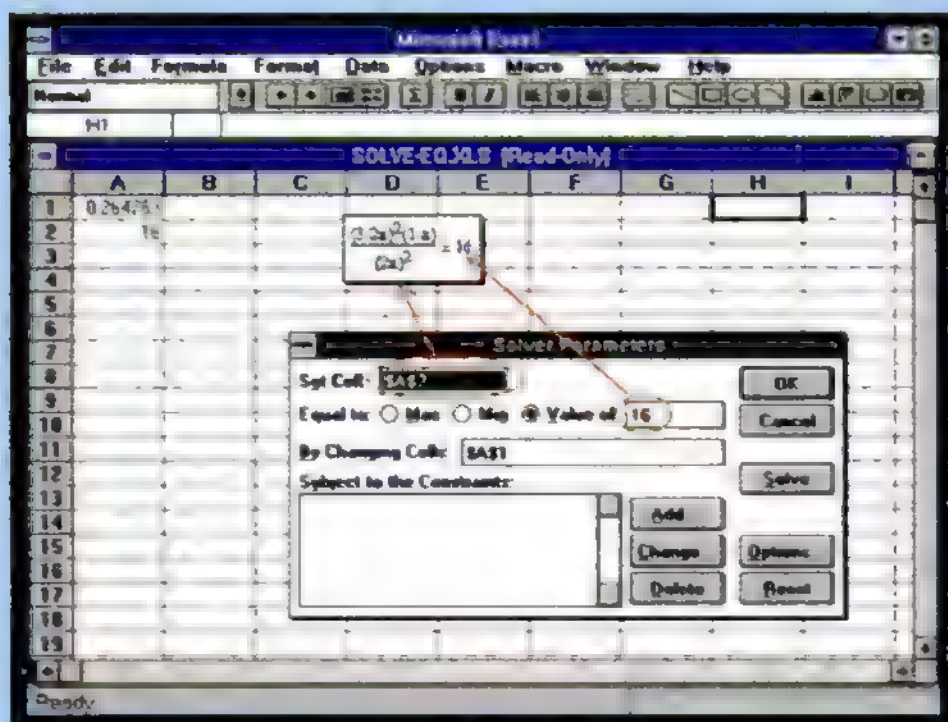
Once you make this change to WIN.INI, the problem is gone for good. If you always print to the same printer port, one visit to the Control Panel will take care of the bug. If you sometimes redirect your LaserJet III output to FILE (or you use more than one printer port), you'll need to apply the fix to each port.

Much obliged, Mr. Gilman. Your tip may save many a frustrated LaserJet III user a call to Microsoft.

HINTS, TIPS, QUESTIONS

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Figure 1: You can use *Excel* 3.0's Solver to solve for single variables in algebraic equations. Here, cell A2 contains the statement on the left side of the equation—the part containing the variable. For similar equations, fill out the dialog box using the same general format, as shown here.



The Working Word

Run the macro, and it prompts you to enter the first question. When you've finished typing it, you should press Enter. The macro then automatically tabs over to your answer, places the letter **a.** beneath the first letter of the answer, and prompts you to type a response. After you've finished entering your answer, the macro asks you if you want to enter another one. If you press y for yes, the macro tabs over to the response level, inserts a **b.**, and prompts you for the text. You may continue adding as many answers as you want to each question. If you press n for no, the macro asks you if you want to add another question. If you answer yes, the macro continues. if you answer no, it

- **MULTIPLE CHOICE EXAMS MADE EASY:** Two *WordPerfect* macros let you create exams and randomly shuffle questions and answers for multiple versions.

quits. Note that the macro uses your own tab settings for indentation, so if you want to change them, you'll have to go into Format (Shift-F8, L, T).

Different levels of indentation give you differing alphanumeric schemes, in this case one level for the questions and one level for the answers. One great benefit of this is that when you create an exam with paragraph numbering, you can shuffle, delete, and add as many questions and answers as you want, and *WordPerfect* will renumber them automatically.

Terry Grignon
Halifax, Nova Scotia
Canada



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A good many teachers, software trainers, and consultants should find this macro quite useful. EXAM.WPM makes it easy to create a standard multiple-choice exam by setting the paragraph definition, prompting you for the input of questions and answers, and automatically numbering and lettering everything as you enter text.

EXAM.WPM begins by defining paragraph numbering (Shift-F5, P). The macro then calls the **makeQ** label, which assigns the number 0 to Variable 1, places an automatic paragraph code at the current cursor position, and indents the cursor one tab space; the text of the question will start at this position. At this point the {INPUT} command prompts the user to enter the text for the question, and the {ENTER} command moves the cursor down an additional line. After an answer is entered, the {CHAR} command in the {LABEL} Answer places a boxed prompt in the top half of the screen. This is the prompt that asks the user if he or she wants to enter another question. The {^<N>}{^<Q>} (Ctrl-<N>, Ctrl-<Q>) statements create the reverse video attri-

EXAM.WPM	COMPLETE LISTING
<pre> (DISPLAY OFF) (})shut-off-display" (Date/Outline)dp{Enter}{Enter} (})Define-Paragraph-numbering" (GO)makeQ" (})Go-to-label-"makeQ"- (LABEL)makeQ" (ASSIGN)1"9" (})Initialize-Var-1" (Date/Outline)p{Enter}{Indent} (})Code-for-Question-number" (INPUT){~T}Type-your-question...Hit-Enter-when-done-{~U}" (Enter) (})Prompt-user-for-question" (LABEL)Answer" (Indent){Date/Outline)p{Enter}{Indent} (})Format-answers" (INPUT){~T}Type-this-answer-text-and-hit-Enter-when-done-{~U}" (Enter) (})Prompt-user-for-response" (GO)AnswerPrompt" (LABEL)AnswerPrompt" (CHAR)9" (~N){~Q} (~P)-[] (~P)-O"Create another answer?-(Y/N)..." (~P)-[] (Up){Left}{Left}{Left}" (CASE){VAR 9}"y"yeah"Y"yeah"N"nope"N"nope" (When-Variable-9-is-equal-to-y -or-Y,call-label-yeah;when-Var9-is -to-N-or-N,call-label-nope -otherwise,call-AnswerPrompt." (LABEL)yeah" (ASSIGN)9"9" (DISPLAY ON) </pre>	<pre> (DISPLAY OFF) (})screen" (GO)Answer" (})Go-to-label-"Answer"- (LABEL)nope" (ASSIGN)9"9" (DISPLAY ON) (DISPLAY OFF) (GO)question" (LABEL)question" (Enter) (DISPLAY ON){DISPLAY OFF} (CHAR)2" (~N){~Q} (~P)-[] (~P)-O"Create another question?-(Y/N)..." (~P)-[] (Up){Left}{Left}" (CASE){VAR 2}"y"yes"Y"yes"(ELSE)"no" (LABEL)yes" (ASSIGN)2"9" (GO)makeQ" (LABEL)no" (ASSIGN)2"9" (BELL) (DISPLAY OFF){DISPLAY ON} (QUIT) </pre>

Figure 1: It's easy to create a standard multiple-choice exam with this macro that uses *WordPerfect's* paragraph-numbering feature.

EDIT WPM	COMPLETE LISTING
<pre> (DISPLAY ON) (CHAR)6 (")(\){F)Wd {P)Wd You are about to shuffle the questions and answers of this exam. First you will be asked to enter a number from 1 to 10. This places the ques- tions in a new order. Then, for each set of answers you will enter a number from 1 to 5. This changes the order in which the answers appear. {P)Wd(")(Q)Type Y to continue or N to exit. (Q)(N){\} {P)Wd {;}Place prompt on screen; Var 6 receives user input of yes or no (CASE)(VAR 6)"nExit"nExit"(Cancel)"Exit"yCont"YCont" {;}Yes response takes macro to "Cont" label; No or Cancel takes macro to "Exit" label (LABEL)Exit" (STATUS PROMPT)" (DISPLAY OFF)(DISPLAY ON) (IF)(STATE)128" (Block) (END IF) (QUIT) {;}Clear prompt from screen {;}Update screen {;}If block is active... {;}...toggle block off {;}End IF statement {;}Quit macro (LABEL)Cont" (STATUS PROMPT)" (DISPLAY OFF)(DISPLAY ON) (HOME)(HOME)(HOME)(HOME)(UP) (DISPLAY OFF) (SWITCH) (IF)(SYSTEM)Document"256" (SWITCH) (GO)shuffleq" (ELSE) (SWITCH) (GO)Doc2Error" (LABEL)shuffleq" (ON CANCEL)(GO)Exit" {;}should Cancel be hit, go to "Exit" label (Search)(Date/Outline)d(Search) (Search)(Date/Outline)p(Search) (HOME)(HOME)(LEFT) (BLOCK) (HOME)(HOME)(DOWN) {;}Go to end of document (TEXT)5"(")(\){F)Wd this exam. Enter a number from 1 to 10. {;}Prompt message at bottom of screen; place answer in Variable 5" (IF)(VAR 5)<1 (VAR 5)>10" {;}If value of Variable 5 is less than 1 or more than 10... (GO)error" (END IF) {;}Go to "error" label {;}End IF statement (Merge/Sort)tpkal(Enter)2(Enter)-(VAR 5)(Exit)cap {;}Go into Sort, set options, and perform sort on questions {;}Go to top of document {;}Clear Variable 5 of any value {;}Search for Par Definition Code {;}Go to "ShuffleAnswer" label (LABEL)ShuffleAnswer" (ON CANCEL)(GO)Exit" {;}should Cancel be hit, go to "Exit" label (TEXT)5" (")(\){F)Wd To shuffle this set of answers: Enter a number from 1 to 5. </pre>	<pre> {;}Prompt message at bottom of screen and place answer into Variable 5" (IF)(VAR 5)<1 (VAR 5)>5" {;}If the value of Variable 5 is less than 1 or more than 5... (GO)ShuffleAnswer" (END IF) {;}Go to "ShuffleAnswer" label {;}End IF statement (Search)(Date/Outline)p(Search) (Search)(Enter)(Search) (HOME)(HOME)(LEFT) (BLOCK) (Search)(Enter)(Enter)(Search) (HOME)(HOME)(HOME)(LEFT) (LEFT) (Block Move)(SWITCH) (Enter) (Replace)n(Enter)(Search)(Enter)(Enter)(Search) {;}Search for Paragraph code {;}Search for first answer {;}Go to left margin {;}Turn on Block {;}Search for last answer {;}Go to left margin {;}Move cursor to left {;}Move text and switch screens {;}Retrieve moved text {;}Place extra return between answers (HOME)(HOME)(UP) (BLOCK) (HOME)(HOME)(DOWN) (Merge/Sort)tpkal(Enter)3(Enter)(VAR 5)(Exit)cap {;}Go to top of document {;}Turn on Block {;}Go to end of document {;}Set Sort options, perform sort of answers {;}Clear Variable 5 of value {;}Go to top of document (Replace)n(Enter)(Enter)(Search)(Enter)(Search) {;}Eliminate extra space between answers (HOME)(HOME)(HOME)(UP) (BLOCK)(HOME)(HOME)(DOWN) (Block Move) (SWITCH) (Enter) (GO)NextAnswer" {;}Return to top of document {;}Block text {;}Move blocked text {;}Switch screens {;}Retrieve moved text {;}Go to "NextAnswer" label (LABEL)NextAnswer" (Search)(Enter)(Enter)(Search) {;}Search for beginning of next question (ON NOT FOUND)(GO)quit" {;}If search fails, go to "quit" label (GO)ShuffleAnswer" {;}Otherwise go to "ShuffleAnswer" label (LABEL)quit" (HOME)(HOME)(UP) (DISPLAY OFF)(DISPLAY ON) (PROMPT)(")(\){F)Wd All questions and answers have been shuffled! {;}Place message at screen bottom {;}Wait a short bit {;}Clear message prompt {;}Quit macro (WAIT)28" (STATUS PROMPT)" (QUIT) (LABEL)error" (HOME)(HOME)(UP) (PROMPT)(")(\){F)Wd Please try again! {;}Go to top of document {;}Place message at screen bottom {;}Wait a short bit {;}Clear message prompt {;}Refresh screen {;}Quit macro (WAIT)28" (STATUS PROMPT)" (DISPLAY OFF)(DISPLAY ON) (QUIT) (LABEL)Doc2Error" (PROMPT)(")(\){F)Wd Other document (SHIFT-F3) MUST be empty to use EDIT macro! {;}Place message at screen bottom {;}Wait a few seconds {;}Clear prompt from screen {;}Refresh screen </pre>

Figure 2: This macro lets you create different versions of an exam by randomly shuffling the questions and answers created with EXAM.WPM.

bute, and the macro positions the message on the screen using {^<P>} (Ctrl-<P>) commands and ASCII characters that represent specific row-and-column positions. (For example, the character ▶ refers to column position 16 and ▣ refers to row 8; you generate these ASCII characters by holding down the Alt key and tapping the appropriate number on the numeric keypad.) The cursor commands place the cursor in the message box. The {CASE} statement that follows assigns to Variable 2 the response the user gives to the prompt and calls either the **yes** or **no** label. The **yes** label returns you to the **makeQ** label, which allows the creation of another question/answer set. The **no** label quits the macro. You should be aware that the {ELSE} in the {CASE} statement ensures that any keystroke other than Y or y is interpreted as a **no**.

To guard against cheating, many teachers create several different versions of a multiple choice exam—a task that could take hours to execute with scissors and paste. To help them out, I've written a companion macro, EDIT.WPM, shown in Figure 2. EDIT uses *WordPerfect's* Sort feature to automate the random shuffling of questions and answers created with EXAM.WPM. When you run it, the macro prompts you to pick a number between 1 and 10. EDIT then uses your answer to pick a word in the first line of each question, and uses the words to sort the questions in ascending order. For instance, if you enter 1, the macro sorts all the questions by the last word in the first line of each question; if you enter 2, it sorts on the second-to-last-word; if you answer 3, it sorts on the third-to-last word, and so on. Once the questions have

been shuffled, the macro prompts you to enter a number from 1 to 5, which it uses to sort the answers in the first question using the same settings it used to sort the questions. It will prompt you this way for each set of answers. The macro's execution is unaffected if your answers have fewer words than the word used to sort.

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by
Neil J. Rubenking

User-to-User

EASIER FILE MANAGEMENT

We have a PC LAN-based electronic mail system in which the messages each user receives are stored on his or her own PC. A colleague asked me if I knew of a way to easily delete all messages dated before a certain date without having to use the delete feature of the e-mail application, which permits only one message to be deleted at a time. I came up with the following solution:

Suppose C:\MESSAGES is the directory that contains the stored e-mail message files. We'd like to delete only those message files dated prior to *mm-dd-yy*. First, set (turn on) the archive bits for all files in C:\MESSAGES:

```
ATTRIB +A C:\MESSAGES\*.*
```

Second, copy the files with the archive bit

■ **EASIER FILE MANAGEMENT: XCOPY helps you delete and archive files created before a given date.**

■ **GETTING THE LENGTH OF A STRING: This unusual batch file calculates the length of a string parameter.**

set and with a date stamp greater than or equal to *mm-dd-yy* to a temporary subdirectory (say, C:\TEMPDIR), and turn off the archive bits of the source files at the same time:

```
XCOPY C:\MESSAGES\*.*  
C:\TEMPDIR\*.* /M /D:mm-dd-yy
```

The /M switch tells XCOPY to copy those files with the archive bit set and reset the archive bits on the source files after copying. The /D switch instructs XCOPY to copy only those files dated on or after *mm-dd-yy*.

Now you can (optionally) back up those files in C:\MESSAGES whose archive bits are still set (those whose dates fall prior to *mm-dd-yy*) to a floppy disk:

```
XCOPY C:\MESSAGES\*.* A:\ /M
```

Next, erase all files in C:\MESSAGES and restore with only the files in C:\TEMPDIR (which contains files from C:\MESSAGES dated on or after *mm-dd-yy*):

```
DEL C:\MESSAGES\*.*  
COPY C:\TEMPDIR\*.* C:\MESSAGES
```

Finally, clean up by removing the temporary subdirectory C:\TEMPDIR.

Kathy J. Kowell
Cincinnati, Ohio



This is a clever use of two features of XCOPY. As Ms. Kowell stated, the /M switch copies files that have the archive bit set and turns off the archive bit of the source files, and the /D switch copies files created on or after a certain date. When these switches are used in combination, they copy files created on or after a certain date that also have their archive bit set, and turn off the archive bit of the source files.

After the XCOPY command has been executed, the temporary directory contains all of the files to be saved, and only those files in the original directory that still have their archive bit set are the ones you're going to dispose of. Now you can easily make backup copies of these files for archival storage.

To make things even easier, I converted the simple instructions above to the batch file shown in Figure 1. It acts on the current directory and includes several ERRORLEVEL checks to make sure that its operations have succeeded before it goes ahead. If the initial XCOPYing of files after the given date fails, the batch program cleans up the temporary directory and then aborts. If the second XCOPY (the one that archives the old files) fails, it skips the line that deletes the old files and reports its failure to the user. DELBEFOR.BAT will be handy in any situation where new files are constantly coming in and old files must be archived and removed.

GETTING THE LENGTH OF A STRING

I read about DIRANY.BAT in the User-to-User column some time ago (June 26, 1990) and decided to try writing a "smarter" batch file. I wanted to create one that could do what DIRANY does, without needing to pass the length of the string. After many hours I finally succeeded, though my solution is far from elegant. DOS batch commands are not geared to working with strings, and there's just no direct way to find the length of one. So the

DELBEFOR.BAT

```
!ECHO OFF  
IF '%1'==' ' GOTO syntax  
IF NOT '%2'==' ' GOTO syntax  
ATTRIB +A *.*  
MD TEMPDIR.###  
XCOPY *.* TEMPDIR.###\*.* /M /D:%1  
IF ERRORLEVEL 1 GOTO error1  
!ECHO Put a backup diskette  
!ECHO in drive A: and  
PAUSE  
XCOPY *.* A: /M  
IF ERRORLEVEL 1 GOTO error2  
IF NOT EXIST *.* GOTO NoFiles1  
!ECHO Y | DEL *.* > NUL  
!NoFiles1  
COPY TEMPDIR.###\*.*  
GOTO cleanup  
:  
:syntax  
!ECHO SYNTAX "DELBEFOR mm-dd-yy"  
GOTO exit  
:  
:error1  
!ECHO Error during initial XCOPY.  
!ECHO Aborting...  
GOTO cleanup  
:  
:error2  
!ECHO Error during archive XCOPY.  
!ECHO Files not deleted.  
:  
:cleanup  
IF NOT EXIST TEMPDIR.###\*.* GOTO NoFiles2  
!ECHO Y | DEL TEMPDIR.### > NUL  
!NoFiles2  
RD TEMPDIR.###  
!exit
```

Figure 1: After archiving them to a floppy disk, this batch file deletes all files created before a given date.

User-to-User

batch file GETLEN.BAT shown in Figure 2 does only that, and not very gracefully.

Eric J. Shelby
West Columbia, South Carolina



As the eminent Dr. Johnson might have said, "Sir, programming in the batch language is like a dog's walking on his hind legs. It is not done well, but you are surprised to find it done at all." Graceful or not, GETLEN.BAT is quite an accomplishment!

For those who didn't see it before, DIRANY.BAT finds files containing a given string either in the filename or in the extension. DIRANY requires you to pass the *length* of the string on the command line as well. For example, the command **DIRANY EX 2** would find EXAMPLE.BAT, TEXT.FIL, and all *.EXE files. It seems redundant to pass the length of the string, and indeed GETLEN.BAT makes this unnecessary. The file itself is a marvel of the batch language's obscurity; we'll have to look it over almost line by line.

```
GETLEN.BAT

@ECHO OFF
IF '%1'=='' GOTO Help
IF NOT '%2'=='' GOTO Used
IF NOT '%3'=='' GOTO Used
MD XXXXXX.$$$
CD XXXXXX.$$$
REM > %1
:loop
SET Z=%1%
REN ???????? %Z????????
IF EXIST %Z% GOTO okay
GOTO loop
:okay
IF %Z%==1 SET N=1
IF %Z%==2 SET N=2
IF %Z%==3 SET N=3
IF %Z%==4 SET N=4
IF %Z%==5 SET N=5
IF %Z%==6 SET N=6
IF %Z%==7 SET N=7
IF %Z%==8 SET N=8
DEL %Z%
CD..
RD XXXXXX.$$$
SET Z=
GOTO exit
:Used
ECHO Environment string 'Z' or 'N'
ECHO already in use...
GOTO Exit
:Help
ECHO Usage: GetLen string
:exit
```

Figure 2: Pass GETLEN.BAT a string and it will return the length of the string in an environment variable.

The first few lines check to make sure that you've passed a string on the command line and that the environment variables Z and N aren't already in use. Next, the batch file creates a temporary subdirectory with an unlikely name and makes it the current directory. In this directory, the batch file creates a 0-byte file whose name is the command line parameter. Now comes the loop that calculates the length of the string.

To understand how that loop works, let's take an example. Suppose we passed the string "PCMAG" to this batch file. Before we enter the loop, there's a file called PCMAG on-disk and the environment variable Z is empty. On our first pass through the loop, the environment variable Z gets set to its current value plus a block character ■ (ASCII 254). Since it was empty before, Z now holds a single

Batch commands are
not geared to working
with strings, and
there's no direct way to
find the length of one.

block character. The REN command that comes next is the key to the process. On this first round, it changes the first character of the 0-byte file's name to an ASCII 254, leaving all other characters the same. Our file is now called ■CMAG. The IF EXIST test comes up false, since there is no file called ■ in this directory, so we go through the loop again.

This time the SET command adds another block, giving environment variable Z the value ■■. The rename command changes the first *two* characters in our filename to blocks, making it ■■MAG. The process repeats three more times, until the file has been renamed ■■■■. Now the filename is the same as the value of Z, so the IF EXIST statement is true and we break out of the loop.

The remainder of the batch file matches the eight possible values of Z with the corresponding numbers 1 through 8. (You should note that any string over eight characters will yield a value of 8.) Then the batch cleans up by deleting the tempo-

DIRANY.BAT

```
@ECHO OFF
IF '%1'=='' GOTO syntax
SET N=
CALL GETLEN %1
SET temp=%1*.*
IF %N%==8 GOTO doit
SET temp=temp %1*.*
IF %N%==7 GOTO doit
SET temp=temp %1*.*
IF %N%==6 GOTO doit
SET temp=temp %1*.*
IF %N%==5 GOTO doit
SET temp=temp %1*.*
IF %N%==4 GOTO doit
SET temp=temp %1*.*
IF %N%==3 GOTO doit
SET temp=temp %1*.*
IF %N%==2 GOTO doit
SET temp=temp %1*.*
:doit
FOR %%f IN (%temp%) DO ECHO %%f
SET temp=
SET N=
GOTO end
:syntax
ECHO DIRANY lists files whose names
ECHO contain a certain string.
ECHO Syntax: "DIRANY string"
ECHO where "string" is a string of
ECHO 1 to 8 characters (no wildcards)
:end
```



Figure 3: This updated version of DIRANY.BAT uses GETLEN.BAT (Figure 2) to avoid needing a redundant command-line parameter.

rary file, removing the temporary directory, and clearing the environment variable Z. At this point, any batch file can call GETLEN to get the length of a parameter, and the result will be returned in the environment variable N.

The version of DIRANY.BAT in Figure 3 uses GETLEN and thereby avoids the need for the redundant second parameter. This batch file uses the CALL command, introduced in DOS 3.3. In this case, you can't substitute COMMAND /C for CALL, because when you invoke a batch file with COMMAND /C, any changes to the environment are lost. If you want to make a version of DIRANY that works with DOS versions before 3.3, simply incorporate the contents of GETLEN.BAT into DIRANY.BAT in place of the CALL line.

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edited by
Trudy Neuhaus

Languages

HOW TO CREATE BOUNCE BAR MENUS

There have been many times when I have wanted to include bounce bar (or highlight bar) menus in my Turbo Pascal programs, but I've always abandoned the idea because they were too complex to create. However, now I use the unit shown in Figure 1, compiling it to disk under the name MENUUNIT.PAS.

To establish a menu object, you have to go through only three steps. First, call the Constructor Init, which will initialize all the necessary variables. Then call the method AddPrompt as many times as you have choices in your bounce bar menu. Last, call the GetChoice method, which will return the selected choice.

Suppose you want a menu with the following choices:

1. Open a New File
2. Existing File

■ **HOW TO CREATE
BOUNCE BAR MENUS:**
This Turbo Pascal unit
makes it easy to add
bounce bar menus to
your programs.

3. Close a File
4. Quit

and there are three procedures (NewFile, ExistingFile, and CloseFile) that will actually perform the necessary actions.

For this type of menu, you will have to write a program like the one shown in Figure 2. Remember that GetChoice returns the number of the option selected, and this number corresponds to the order in which choices are sent. Now let's take

a look at how it works.

The entire system depends on a linked list. When you call Init, it initializes a linked list and sets all necessary variables. Then, with each call to AddPrompt, a new node is added to the menu at the appropriate position with the value passed to AddPrompt. Finally, when GetChoice is called, it highlights the first entry. Then, if Left Arrow or Up Arrow is pressed, the previous entry is highlighted. Similarly, pressing Right Arrow or Down Arrow highlights the next entry. This process repeats until the Enter key is pressed, which returns the value of the highlighted menu option, or until the Esc key is pressed, which abandons the operation and returns 0. The Home key highlights the first choice, and the End key highlights the last choice.

Yasir Liaqat Ullah
Peshawar, Pakistan

MENUUNIT.PAS1 OF 2

```
UNIT MenuUnit;
(**) INTERFACE (**)
USES CRT;
CONST MaxMsgLen = 32;
TYPE
  MessageString = String[MaxMsgLen];
  EntryPointer = ^EntryType;
  EntryType = OBJECT
    Prev, Next      : EntryPointer;
    XCor, YCor, ChoiceNo : Integer;
    Message          : MessageString;
  CONSTRUCTOR Init(lpr, lpx : EntryPointer; lx, ly,
    lc : Integer; lm : MessageString);
  PROCEDURE Draw(selected : Boolean);
  FUNCTION GetChoice : Integer;
END;

BMenu = OBJECT
  XCor, YCor, Wid, Choices : Integer;
  FirstEntry, CurEntry      : EntryPointer;
  CONSTRUCTOR Init(lx, ly, lw : Integer);
  DESTRUCTOR Done;
  PROCEDURE AddPrompt(lm : MessageString);
  PROCEDURE Draw;
  FUNCTION GetChoice : Integer;
END;

(**) IMPLEMENTATION (**)
CONSTRUCTOR BMenu.Init(lx, ly, lw : Integer);
BEGIN
  XCor := lx;
  YCor := ly;
  Wid := lw;
  IF Wid > MaxMsgLen THEN Wid := MaxMsgLen;
  IF XCor+Wid > 80 THEN Wid := 80 - XCor;
  FirstEntry := NIL;
  Choices := 0;
END;

DESTRUCTOR BMenu.Done;
BEGIN
  IF FirstEntry <> NIL THEN
```

```

  BEGIN
    FirstEntry^.Prev^.Next := NIL;
  REPEAT
    CurEntry := FirstEntry;
    FirstEntry := FirstEntry^.Next;
    Dispose(CurEntry);
  UNTIL FirstEntry = NIL;
END;

PROCEDURE BMenu.AddPrompt(lm : MessageString);
VAR EP : EntryPointer;
BEGIN
  Inc(Choices);
  {pad with spaces}
  FillChar(lm[length(lm)+1], Wid-length(lm), ' ');
  lm[0] := Char(Wid);
  IF FirstEntry = NIL THEN
    BEGIN
      FirstEntry := New(EntryPointer, Init(NIL,
        NIL, XCor, YCor+Choices-1,
        Choices, lm));
      FirstEntry^.Next := FirstEntry;
      FirstEntry^.Prev := FirstEntry;
    END
  ELSE
    BEGIN
      EP := New(EntryPointer, Init(FirstEntry^.Prev,
        FirstEntry, XCor, YCor+Choices-1,
        Choices, lm));
      FirstEntry^.Prev^.Next := EP;
      FirstEntry^.Prev := EP;
    END;
END;

PROCEDURE BMenu.Draw;
VAR ro, co : Byte;
BEGIN
  GotoXY(XCor-1, YCor-1); Write($210);
  FOR co := 1 TO Wid DO Write($196); Write($191);
  FOR ro := YCor TO YCor + Choices - 1 DO
    BEGIN
```

Figure 1: This Turbo Pascal unit defines a simple menu box object.

MENUUNIT.PAS
2 OF 2

```

GotoXY(xCor-1, ro); Write($179);
GotoXY(xCor+wid, ro); Write($179);
END;
GotoXY(xCor-1, yCor+Choices); Write($192);
FOR co := 1 to wid DO Write($196); Write($217);
CurEntry := FirstEntry;
REPEAT
  CurEntry^.Draw(FALSE);
  CurEntry := CurEntry^.Next;
UNTIL CurEntry = FirstEntry;
END;

CONST
  kEnter = $000D; kEsc = $001B;
  kHome = $4700; kEnd = $4F00;
  kLeft = $4B00; kRight = $4D00;
  kDown = $5000; kUp = $4800;

FUNCTION BBMenu.GetChoice : Integer;
VAR
  SaveX, SaveY : Integer;
  Finished : Boolean;
  InChar : Char;
  InWord : Word;
BEGIN
  SaveX := WhereX;
  SaveY := WhereY;
  Draw;
  Finished := FALSE;
  REPEAT
    CurEntry^.Draw(TRUE);
    InChar := ReadKey;
    IF (InChar = $0) AND KeyPressed THEN
      BEGIN
        InChar := ReadKey;
        InWord := Word(InChar) SHL 8;
      END
    ELSE InWord := Ord(InChar);
    CurEntry^.Draw(FALSE);
    CASE InWord OF
      kLeft, kUp : CurEntry := CurEntry^.Prev;
      kRight, kDown : CurEntry := CurEntry^.Next;
      kHome : CurEntry := FirstEntry;
      kEnd : CurEntry := FirstEntry^.Prev;
      kEsc : BEGIN
        Finished := True;
        GetChoice := 0;
      END;
      kEnter : BEGIN
        Finished := True;
        GetChoice := CurEntry^.GetChoice;
      END;
    END;
  UNTIL Finished;
  GotoXY(SaveX, SaveY);
END;

CONSTRUCTOR EntryType.Init(iPr, iNx : EntryPoint;
  ix, iy, ic : Integer;
  iM : MessageString);
BEGIN
  Prev := iPr;
  Next := iNx;
  XCor := ix;
  YCor := iy;
  ChoiceNo := ic;
  Message := iM;
END;

PROCEDURE EntryType.Draw(Selected : Boolean);
BEGIN
  IF Selected THEN TextAttr := $70
  ELSE TextAttr := $07;
  GotoXY(XCor, YCor);
  Write(Message);
END;

FUNCTION EntryType.GetChoice : Integer;
BEGIN GetChoice := ChoiceNo; END;

END.

```



The menu system used as an example just cried out to be object-oriented, so I revamped the original code to make it so. The individual menu items are now objects, and the menu itself is another object. You just specify the *x* and *y* coordinates of the upper-left corner of the menu, and its width. Then, as you call `AddPrompt`, the

menu adds new items to itself at the proper location.

When you call `GetChoice`, the menu object first draws itself on the screen. It draws an empty frame, then calls on each of its menu-item objects to draw itself in its proper place. The user input loop is fairly simple. First, it calls the menu item pointed to by the `CurrentEntry` field to

draw itself highlighted. Then it waits for a keystroke, which it processes into a `Word` value. After getting the keystroke, it tells the current menu item to draw itself *unhighlighted*. According to the keystroke, it sets `CurrentEntry` to a new value. This all continues until you either make a selection or hit `Esc`.

There are a number of enhancements you may wish to add to this menu system before recompiling the code with Version 5.5 or later. The most obvious is saving and restoring the area under the menu box. But there's a more interesting possibility. What if you made `BBMenu` a descendant of `EntryType`? It already shares the `XCor` and `YCor` fields, and it has a `Draw` method and a `GetChoice` method. With a little effort, you could even build the possibility of submenus into the system!—Neil J. Rubenking

MENUDEMO.PAS
COMPLETE LISTING

```

PROGRAM MenuDemo;
USES MenuUnit, Crt;
VAR
  Choice : Integer;
  M : BBMenu;
BEGIN
  M.Init(25, 7, 18);
  M.AddPrompt('Open a new file');
  M.AddPrompt('Existing file');
  M.AddPrompt('Close a file');
  M.AddPrompt('Quit');
  Choice := M.GetChoice;
  GotoXY(1, 24); ClrEOL;
  CASE Choice OF
    0 : WriteLn('No choice was made');
    1 : WriteLn('Procedure NewFile should be called');
    2 : WriteLn('Procedure ExistingFile should be called');
    3 : WriteLn('Procedure CloseFile should be called');
    4 : WriteLn('Quitting ...');
  END;
  M.Done;
END.

```

Figure 2: This program shows how simple it is to create and execute a menu box when you use the `MenuUnit` shown in Figure 1.

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by
Jeff Prose

Tutor

LOADING HIGH

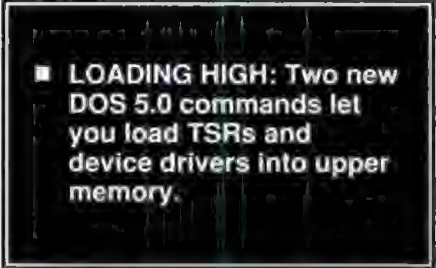
In the last column, we explored DOS 5.0's new DOSKEY utility, which adds long-awaited enhancements to DOS's command line interface by allowing you to recall old commands, edit text on the command line, build stroke-saving command macros, and more. Now we'll look at another addition to the operating system: the **LOADHIGH** and **DEVICEHIGH** commands, which let you load TSRs and device drivers into upper memory on 386-based PCs.

Upper memory is the region between 640K and 1MB. Until the 386 was introduced, this area was reserved for the video buffer, the BIOS, adapter ROMs, and various other hardware needs. Technically, it still is. But along with the 386 came Virtual 86 mode and the ability to map extended memory into unused address spaces in upper memory, creating pockets of usable RAM called *upper memory blocks* (UMBs) that could be addressed by real-mode application programs. (For a look at how this works, refer to the January 16, 1990, Tutor column.) Utilities such as **LOADHIGH** and **DEVICEHIGH** can place TSRs and drivers into this region, where they won't take memory from programs running in the lower 640K.

The ability to load programs into upper memory is nothing new. Utilities such as **386MAX** from Qualitas and **QEMM-386** from Quarterdeck Office Systems have been doing it for years. The difference now is that DOS does it without any help from third-party utilities. If you have a 386 or a 486 with 1MB or more of memory and are running DOS 5.0, loading programs and drivers in upper memory can increase the amount of RAM available for transient program loading by as much as 130K.

THE LOWDOWN ON LOADING HIGH

The diagrams in Figure 1 will help you understand how loading programs and device drivers in upper memory can make



■ **LOADING HIGH:** Two new DOS 5.0 commands let you load TSRs and device drivers into upper memory.

more memory available to applications loaded in the lower 640K. In the left-hand diagram, which illustrates the conventional way of loading TSRs, RAM-resident programs occupy a block of lower memory located just above **COMMAND.COM**. Application programs are loaded and run above this block, so they have the area that extends from that point to the top of conventional memory to work in. In upper memory, the 64K blocks at segments **A000h** and **B000h** are reserved for the video buffer, while segments **E000h** and **F000h** are set aside for the ROM BIOS. The address space from segment **C000h** to **DFFFh** is unused. (This is a typical configuration for IBM PS/2s and for many 386 and 486 systems equipped with VGAs, but it does vary from system to system.)

The diagram on the right illustrates the effect of loading TSRs high rather than low. The block dedicated to the TSRs has been shifted from conventional memory to upper memory, increasing the size of the area that transient application programs can run in by the combined length of the TSRs. Moreover, there's enough upper memory left over to load additional TSRs high. Because the **EMM386.EXE** driver mapped extended memory into the unused address space, making it usable RAM, and because the CPU can access upper memory without entering protected mode, DOS 5.0 can use it to load RAM-resident programs. If you load enough TSRs and device drivers to fill up this block, you effectively gain that much additional memory for your application programs to run in.

PREPARING TO USE LOADHIGH AND DEVICEHIGH

Before you can use the **DEVICEHIGH** and **LOADHIGH** commands, three conditions must be met:

- The device driver **HIMEM.SYS** must be loaded with a **DEVICE=** statement in **CONFIG.SYS**.
- The device driver **EMM386.EXE** must be loaded. It, too, is loaded with a **DEVICE=** statement in **CONFIG.SYS**, and that statement must come after the one that loads **HIMEM.SYS**.
- **CONFIG.SYS** must contain the statement **DOS=UMB**.

HIMEM.SYS is an XMS (Extended Memory Specification) driver that allows programs to use memory above 640K in a cooperative manner. Most of the time, the simple statement

```
DEVICE=C:\DOS\HIMEM.SYS
```

is enough to load it and get it working (assuming, of course, that it's stored in **C:\DOS**). If **DOS=HIGH** appears in your **CONFIG.SYS** file, DOS is loaded into the first 64K of extended memory, the *High Memory Area* (HMA), rather than conventional memory. If you receive an error message when **HIMEM** is installed or have problems running DOS in the HMA, you may need to install **HIMEM.SYS** with a **/MACHINE** switch that matches an A20 handler to the type of PC you're running it on. (An A20 handler is the routine **HIMEM** uses to manipulate the A20 address line to gain access to the HMA.) Your DOS manual details the **/MACHINE** codes that **HIMEM.SYS** supports.

It is the **EMM386.EXE** device driver that creates the upper memory blocks (UMBs) programs and drivers are loaded into. If you wish, it will also make LIM 4.0 expanded memory available to programs that are EMS-aware. In order to use upper memory for program loading, the **DEVICE=** statement that loads **EMM386.EXE** must contain a **RAM** or

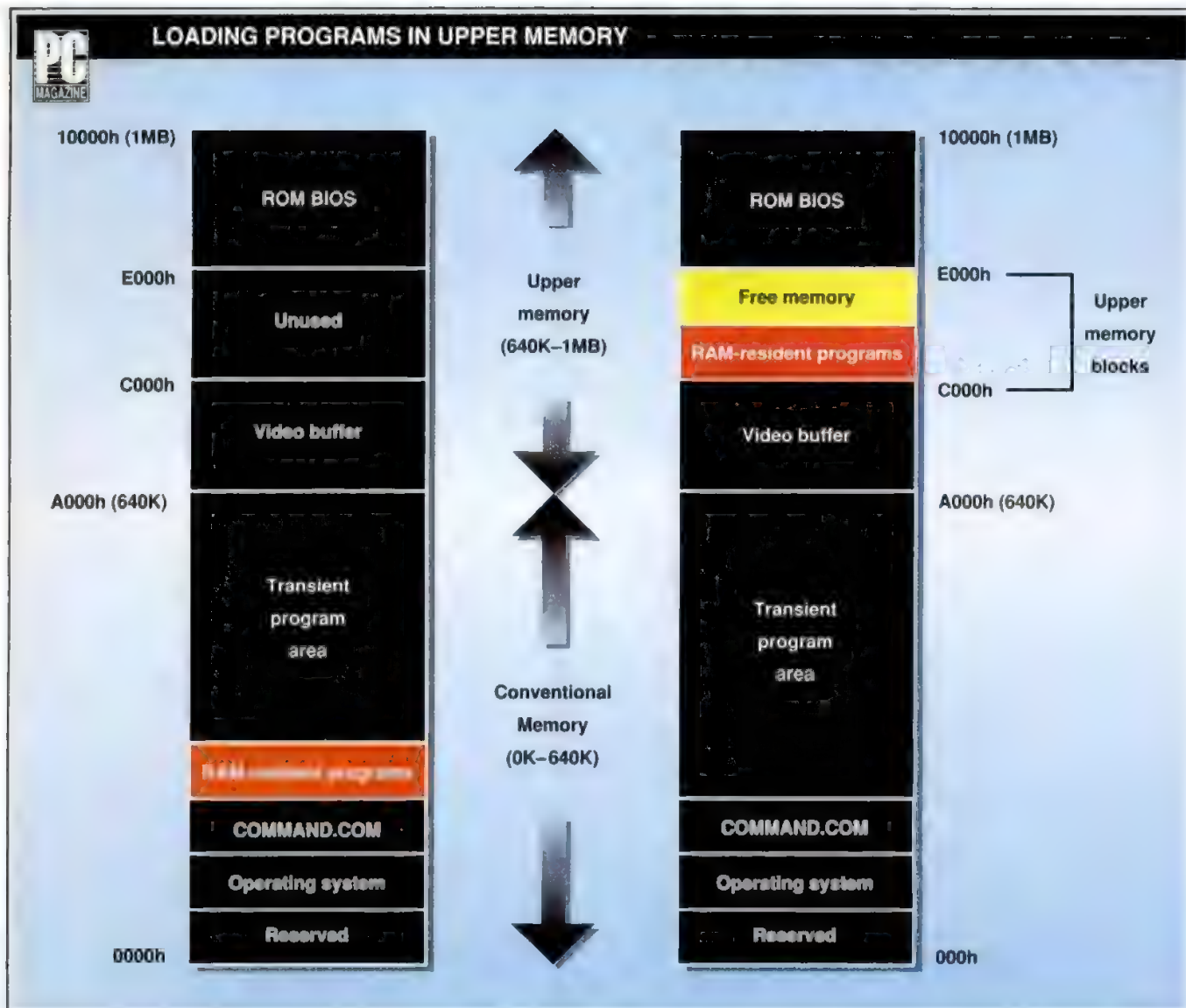


Figure 1: Loading TSRs and device drivers in upper memory on properly equipped 386 and 486 systems running DOS 5.0 can make as much as 130K of extra memory available to programs run in conventional memory. The diagram on the left illustrates how memory may be configured on a typical 386 PC without the benefit of DOS 5.0's EMM386.EXE driver, with TSRs loaded in conventional memory and the address space from C0000h to DFFFFh unused. The diagram on the right shows the same system with EMM386.EXE loaded and TSRs installed in upper memory. Note that the room that application programs have to run in below 640K has increased by the combined length of the TSRs.

NOEMS parameter that looks like this

```
DEVICE=C:\DOS\EMM386.EXE NOEMS
```

or this

```
DEVICE=C:\DOS\EMM386.EXE RAM
```

NOEMS tells EMM386.EXE to create UMBs for program loading but not to provide EMS services to application programs. RAM tells it to create upper

memory blocks and to provide EMS services. If you don't include either parameter, EMM386 provides expanded memory to programs that need it but doesn't create UMBs for LOADHIGH and DEVICEHIGH to work with.

The statement DOS=UMB causes two things to happen. First, DOS places a series of calls to HIMEM.SYS to allocate for itself all the UMBs created by EMM386.EXE. Second, DOS sets up one or more memory control blocks (MCBs)

in upper memory similar to those it sets up in conventional memory to map the logical structure of memory. The format of these MCBs and the way DOS uses them were discussed in the April 16, 1991, Tutor column.

DOS manages upper memory the same way it manages lower memory: by carving it into a series of blocks according to application programs' requests and placing a 16-byte MCB before each block, which identifies the block's size, its

It's A Great Book. But Don't Take Our Word For It. Read This.

PERSONAL COMPUTERS

Some Sound Advice On Taking It Along

By PETER H. LEWIS

For anyone who has ever considered buying a laptop or notebook computer, or who has done so and is now trying to cope with all the little quirks that accompany portable computing, we enthusiastically recommend "The PC Magazine Guide to Notebook and Laptop Computers," by Bill Howard (\$29.95 from the Ziff-Davis Press, Berkeley, Calif.). It is the most enlightening, practical and comprehensive book on DOS-based portable computing we have seen.

The category of laptops and notebooks is one of the fastest-growing segments of the computer industry and perhaps the fastest-changing. New chip and manufacturing technologies have allowed portable PCs to get smaller and lighter while nearly matching the power of desktop systems. This guide helps the reader find the best laptop or notebook computer for his or her needs, at the best price.

It doesn't stop there, though. Laptop computer owners know that they have greater freedom to work on the road or at the beach, but they also quickly discover that a 7-pound laptop seems to weigh 20 by the end of a trip, that most hotels make it difficult to connect the portable PC to a phone line, that fax modems are treacherous things and that transferring files from the laptop to a desktop computer or a network is often harder than it

looks. In short, little computers can cause big headaches. This book is better than aspirin. Tuck it into the flight bag; it is well worth the extra weight. Mr. Howard is executive editor of PC Magazine, which is known for its exhaustive reviews of computer

products and technologies. He also compiles a regular column on computer-related humor, and he manages to combine both his technical expertise and his droll wit in this book, which makes it easy to read as well as informative.

Most of the tips pay off in tangible ways. For example, computer dealers sell most of their machines to businesses, so an individual consumer must act businesslike to get the best deal. Mr. Howard includes a sample price-quote form that makes it easier to compare features and prices. There are how-to sections on communications, recommendations on must-have accessories and peripherals, advice on selecting software, a primer on how to manage phone lines at home and a troubleshooting guide, among other helpful tips.

Some of the tips are arcane. For example, if you're flying from New York to Texas with your portable computer, sit on the starboard (dark) side of the plane to get the best screen visibility. If you commute by train, remember that most cars have at least one AC power outlet that you can use instead of draining the battery, but watch out for power surges. If you stay at a higher-class hotel, you may have a better chance of finding an accessible phone jack in the bathroom, but be careful to keep the toilet seat down.

Although "The Guide to Notebook and Laptop Computers" is surprisingly thorough, there are some things that a reader will not find in its nearly 400 pages.

Most important, one will not find specific recommendations on brand names or models. Instead, Mr. Howard gives his readers the background to make their own evaluations, and just as important, advice on how to

evaluate the evaluations in other sources, including computer magazines, newspapers and newsletters. Also, the guide assumes that the reader has a general familiarity with computers. Absolute beginners will find clear explanations of the various components of the computer system, but little in the way of basic PC instruction.

Nor will owners of the Apple Macintosh Portable, or any of its Frankensteinian clones, find any solace here; this is a DOS and Windows book only. Handheld and palmtop devices such as the Algor Portfolio, Sharp Wizard or Hewlett-Packard 95LX get little more than cursory coverage.

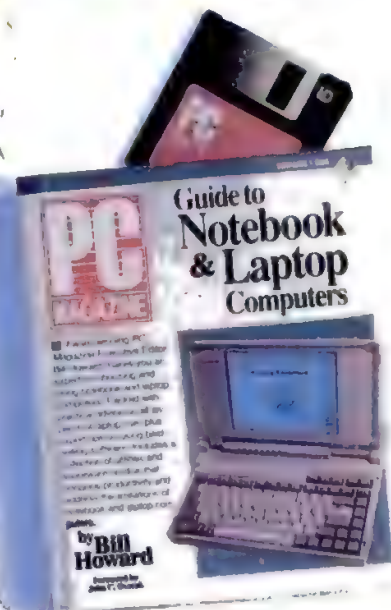
The guide comes with a 3.5-inch diskette that includes 18 utility programs that make laptop computing more convenient. Among the programs are one that highlights the active line of the laptop display, making it easier to read, and others that

THE NEW YORK TIMES SCIENCE TUESDAY, JULY 9, 1991



A guide to portables doesn't name brands, but helps you choose.

automate the retrieval of electronic mail on the MCI and Compuserve services.



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The New York Times recently printed a review of *PC Magazine Guide to Notebook and Laptop Computers*. In it, writer Peter H. Lewis said "it is the most enlightening, practical and comprehensive book on DOS-based portable computing we have seen." If you want the best guide to Laptops and Notebooks, pick up the phone and order this book today. **1-800-688-0448**

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Tutor

owner, and whether there are more blocks succeeding it in memory.

USING LOADHIGH AND DEVICEHIGH

Once you've set up your system to accommodate LOADHIGH and DEVICEHIGH, loading programs and drivers into upper memory is easy. The LOADHIGH command installs a TSR high. Its syntax looks like this:

```
LOADHIGH [d:][path]filename  
[parameters]
```

where *filename* is the name of the program to be loaded high and *parameters* indicates an optional list of command line parameters to go with the program. If you wish, you may abbreviate the LOADHIGH command to LH. For example, using either

```
LOADHIGH GRAPHICS LASERJETII
```

or

```
LH GRAPHICS LASERJETII
```

loads DOS 5.0's GRAPHICS command (which is actually a TSR) high and sets it up to interface to a LaserJet II printer. You don't have to include the three-letter extension on the filename unless you want to. And if you don't specify a path to the file, LOADHIGH automatically searches the current directory and the directories specified in the PATH command. This is exactly what COMMAND.COM does when it looks for an executable file whose name you type on the command line.

If there isn't enough upper memory available to load the TSR, LOADHIGH will load it in conventional memory instead. You can find out where it is loaded by typing

```
MEM /C
```

MEM /C lists the programs loaded in conventional and upper memory and tells you how much space each one occupies. The easiest way to use LOADHIGH is to insert LH or LOADHIGH in front of every command in your AUTOEXEC.BAT that loads a TSR. If there's enough upper memory to hold all the TSRs you install, this simple change will load eve-

rything high and free up precious space in the lower 640K.

DEVICEHIGH is very similar to LOADHIGH except that it loads device drivers rather than TSRs into upper memory, and like the DEVICE= statement, it can be used only in CONFIG.SYS. The command

```
DEVICEHIGH=C:\DOS\ANSI.SYS
```

loads ANSI.SYS into upper memory. Like the LOADHIGH command, DEVICEHIGH defaults to loading a driver into conventional memory if there's not enough room for it in upper memory. When you install DEVICEHIGH, you can also specify the minimum amount of memory that must be available for a driver to be loaded in upper memory. The following statement

```
DEVICEHIGH SIZE=2000  
C:\DRIVERS\MOUSE.SYS
```

loads MOUSE.SYS into upper memory only if there is at least 8,192 (2000 hex) bytes of upper memory available. This is useful for installing drivers that allocate additional buffer space for themselves once they're started. By default, DOS only allocates a driver the number of bytes that is required to hold it. If the driver attempts to allocate more space and there isn't enough contiguous upper memory available to meet its request, your PC may lock up. For this reason, it's a good idea to have a DOS 5.0-formatted floppy disk on hand anytime you experiment with DEVICEHIGH, just in case you unintentionally render your hard disk unbootable.

How do you know what SIZE to use? First load the device driver low with a DEVICE= command and use MEM /C to determine how much space it occupies. Then set SIZE equal to or slightly larger than that value. Be sure to enter it in hexadecimal.

If the device driver still won't run, it may simply be incompatible with upper memory. If so, you'll have to load it low.

TROUBLESHOOTING UPPER MEMORY

Some TSRs and drivers are incompatible with upper memory and shouldn't be loaded there. If a TSR or device driver starts behaving erratically or locks up your system when you've loaded it high, that's one indication it should be loaded low. All of the TSRs shipped with DOS

5.0, including DOSKEY, FASTOPEN, and others, may be loaded high. The device drivers supplied with DOS 5.0 can be loaded high, with the exceptions of HIMEM.SYS and EMM386.EXE. Attempting to load either with DEVICEHIGH results in the driver's being placed in low memory instead.

Sometimes the order in which you load TSRs and drivers affects how many of them can be loaded. DOS always loads a TSR or driver into the largest available UMB. If the upper memory area is divided into two or more UMBs, the load order is particularly likely to affect the way programs are loaded, because the largest available UMB may change after each new program is loaded. Also, if a program needs temporary buffer space immediately after it's loaded but relinquishes this space before terminating, it may not install high unless it's loaded early while there is still plenty of memory available.

Let's say you have 60K of upper memory free and you want to load two TSRs there. Typing MEM /C reveals that program A consumes 20K of memory, while program B requires 30K. As long as program A is loaded first, program B installs fine. But if program B is loaded first, program A will not install. Why? Because program A requires 20K of additional memory for temporary storage space in addition to the 20K needed to hold its own code and data. If program B is loaded first, there's only 30K of memory left to be claimed when program A is installed. Unable to allocate enough memory for itself, program A terminates without becoming RAM-resident.

If, however, program A is loaded before program B, there's a full 60K of RAM for it to work in and the installation proceeds smoothly. This is only one of many scenarios in which a TSR may be prevented from loading high. However, it illustrates how varying the load order might enable you to fill upper memory more completely.

Most of the time, however, you can manage pretty well by loading programs in order of size, from largest to smallest. When that method doesn't work, you'll have to experiment with different load orders to determine which one works best. If it comes to this, load the programs one at a time and use MEM /C to discover how much space each requires. Then vary the load order to determine empirically whether a different order might allow

Tutor

more TSRs to be loaded. Note that 386MAX and QEMM-386, unlike DOS 5.0, come with utilities that determine the optimum load order for you.

MORE MEMORY

TSRs and device drivers aren't the only things you can use upper memory for. Two new API calls in DOS 5.0 let application programs allocate memory above 640K for their own use. The first one, function 58h, subfunction 01h, permits an application to specify DOS's memory allocation strategy. When this function is called, the lower 2 bits of the word in BX tell DOS what type of strategy to use (0=first fit, 1=best fit, 2=last fit) while bit 7 tells DOS where to begin the search for memory to satisfy an allocation request. If bit 7 is set to 0, low memory is searched first; if it's 1, then upper memory is searched first. If the latter strategy, called *high first*, is employed, requests for memory placed through DOS function 48h (Allocate Memory) will be granted

with a UMB if there's a UMB large enough to meet the request.

The second new memory-related function in DOS 5.0 is function 58h, subfunction 03h. Calling this function with BX set to 1 tells DOS that UMBs can be used to satisfy memory requests, in effect putting upper memory on equal footing with lower memory. DOS calls this *setting the link status*. The link status must be set before upper memory can be allocated, even if a high-first allocation strategy is currently in effect (calling subfunction 01h with bit 7 of BX set to select high-first memory allocation does not automatically set the link status). If the link status isn't set, upper memory doesn't exist as far as application programs are concerned. The upshot of all this is that applications written for the DOS 5.0 environment now have access to more memory than ever before if they are UMB-aware.

Don't forget that LOADHIGH and DEVICEHIGH aren't the only commands DOS 5.0 provides for freeing up memory in the lower 640K. Placing the statement DOS=HIGH in CONFIG.SYS on a 386 or 486 PC loads most of DOS itself into the HMA. Space permitting, BUFFERS

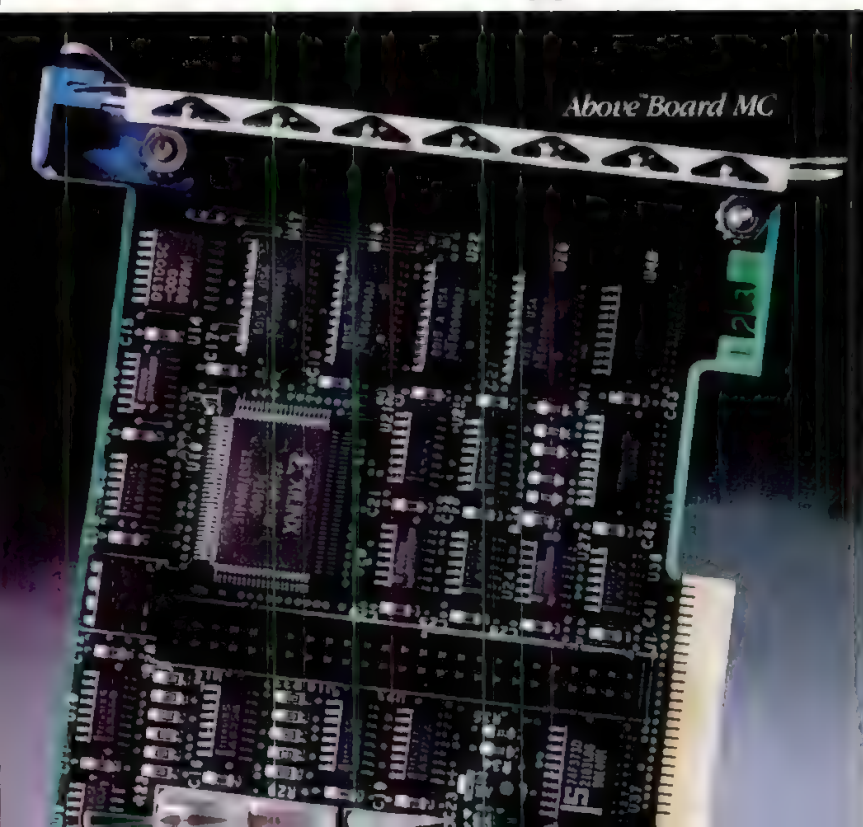
go in the HMA also (normally, there's room for about 48 disk buffers in the HMA after DOS is loaded there).

The result? You can free up as much as 64K of conventional memory by making one simple change to CONFIG.SYS. With all these tools at your disposal, it's not uncommon to have a PC running DOS 5.0 stuffed full of TSRs and device drivers and still have more than 600K of RAM left for application programs. While it's still no panacea for real-mode memory woes, DOS 5.0 is at least a giant step in the right direction.

ASK THE TUTOR

The Tutor solves practical problems and explains techniques for using your hardware and software more productively. Questions about DOS and systems in general are answered here. To have your question answered, write to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload it to PC MagNet (see the PC MagNet News page immediately following the Utilities column for access instructions). We're sorry, but we're unable to answer questions individually. ■

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a system cost analysis. Contact UDS at 800/451-2369 (in Alabama, 205/430-8000); FAX 205/430-8926.

CIRCLE 367 ON READER SERVICE CARD



by
Frank J. Derfler, Jr.

Connectivity

HASSLE-FREE FAX

Here's a product that many users will find interesting. Ibis Software teamed up with AT&T to produce *GoFax*, a \$69 software package that links your desktop or laptop computer to AT&T's fax service. Whenever you want to send a fax, you run *GoFax* and it dials AT&T's Fax Service Bureau. The software is very easy to use, and AT&T ensures transmission of the fax, so you can go on and do other things.

The *GoFax* software calls the AT&T bureau on a toll-free 800 number. The charge is \$3.00 for the first page of the message and \$2.50 for each additional page. There are no monthly or other fees.

Unfortunately, the *GoFax* system can't handle incoming faxes. The problems PCs have displaying inbound faxes will limit this activity for a long time to come. But if you want hassle-free fax transmission from anywhere you might be, you can contact Ibis Software at 415-546-1917.

CONNECTING MACS WITH PCs

What's the most straightforward way to allow a Macintosh SE computer on a LocalTalk network to access a network of PCs running Novell's *NetWare*, Version 3.11, over a Gateway Communications 10BaseT network wiring system? I'd like the Mac SE user to have the option of storing files either on the LocalTalk server or on the Novell server.

Also, can you recommend an e-mail package for communications between the Mac and the networked PCs?

Mike Jasiewicz

Laguna Niguel, California



First, let's get the terms straight, and then I'll describe how easy it is to integrate Macs into a network of PCs under *NetWare*.

Many Macintosh users don't understand the difference between LocalTalk and AppleTalk. Both are standards created by Apple. LocalTalk specifies the physical and electrical connection between Macintosh systems, much as the

- **HASSLE-FREE FAX:** An easy way to send a fax.
- **CONNECTING MACS WITH PCs:** Macintosh computers link easily into *NetWare* LANs.
- **MODEM TO GO:** A handy adapter lets you easily attach your modem to the handset of any phone.
- **SAVING MEMORY:** You really can't use a 286 to run bridge software and applications.
- **PROTECTING YOUR NETWORK:** The best UPS system is one that lets you monitor power across your entire network.

IEEE 802.3 standard defines the physical and electrical connections on an Ethernet network. AppleTalk, on the other hand, specifies the protocol or methodology used by Macs to communicate with one another. Macintosh computers always communicate in AppleTalk, even over Ethernet or Token-Ring cabling schemes.

On a PC running *NetWare*, DOS requests for network disk and printer resources are translated into *NetWare* messages by the *NetWare* NETx and IPX programs. On a Macintosh, the *AppleShare Workstation* program, which is included with every Mac, handles these tasks. The *Workstation* software converts requests for network disk and printer resources into AppleTalk messages. These messages are sent over the network in their original AppleTalk format, regard-

less of the type of cable used. When the messages reach the server, they are translated into *NetWare*-compatible messages by a special program running on the server.

Novell's *NetWare for Macintosh* runs on the *NetWare* server and offers Macintosh users the same services PC users get. From a Mac, you can access shared files on a file server and print to network print queues. Macintosh files stored on a *NetWare* server look and act just like files stored on a local Macintosh disk. *NetWare* supports the long filenames and icons of the Mac desktop. *NetWare* servers appear on the Mac desktop the same way that local hard and floppy disk drives do. If the application programs are compatible, Mac users and PC users can access the same files simultaneously.

You access network printers through the Chooser, just like local printers. Normally, only PostScript and ImageWriter printers are available to the Macintosh client user, but it's easy to make other printers available as well. A single *NetWare* print queue can service both Macintosh and PC clients.

There are several ways to connect your Macintosh to an existing *NetWare* network. Because of the limited expansion capability of the Mac SE, your best choice is to put a LocalTalk LAN adapter in the *NetWare* server and to use the Macintosh's built-in LocalTalk capability to connect your Macintosh to the network. Only one *NetWare* server on the network needs to have a LocalTalk board; other *NetWare* servers can be reached through the LocalTalk-equipped server. *NetWare* servers can house up to four different LAN adapters, so you can create a network with some Macs connected through LocalTalk and other Macs with more expansion capability connected, along with PCs, through Ethernet (including 10BaseT) or Token-Ring. You can customize access according to the needs of each user and your budget.

With a signaling speed of 250 kilobits per second, LocalTalk is relatively slow.

Connectivity

But if you use the network only for printing and occasional file access, LocalTalk may be all you need.

Note that LocalTalk connectors are notoriously easy to disconnect. If you disconnect the cable at any point, you effectively break the LocalTalk network into two separate networks! You can quickly troubleshoot a LocalTalk wiring problem by determining which stations can see which other stations.

As for an e-mail package that enables communications between Macs and PCs, I'd recommend either *cc:Mail* or *Microsoft Mail* (Microsoft's new rendition of its *NetWork Courier* program). Both of these packages support Intel-based PCs running DOS and *Windows* as well as Apple Macintosh computers.

MODEM TO GO

I travel a lot with my laptop and I run into all sorts of telephone systems in hotels. I've taken to carrying clip leads and screwdrivers and generally acting like a bomb disposal expert as I take apart the telephone box to make a modem connection, but often I'm still defeated by the signaling between the phone and the PBX. Is there a way to use the handset of the hotel room telephone so that I don't have to tap the innards of the wiring system?

Chris Faar

Brooklyn, New York



Information Machines (818-884-5779) offers an acoustic coupler that connects to the RJ-11 jack of any external or internal modem and then attaches to any telephone handset you're likely to find in a hotel room—even the Mickey Mouse phones popular in the hotels in Orlando, Florida. The \$179 MA-100 modem adapter contains an internal battery so it won't overload the power supply of your laptop, and if the telephone line is good, it will operate at speeds of up to 2,400 bps. It folds down to a palm-size package and weighs about 6 ounces with the battery. The MA-100 should solve your traveling connectivity problems.

SAVING MEMORY

I'm the administrator of a *NetWare* LAN with 20 users on both Ethernet and Token-Ring adapters. The PCs on the To-

ken-Ring LAN take more RAM because of the two device drivers loaded along with IPX and NET3. I saved some memory by using Version 3.01 of the *NetWare* shell, which loads NET3 to high or expanded memory. But I gained much more memory using DR DOS 5.0 to load the device drivers and IPX into high memory as well.

I also have a 286-based PC acting as a nondedicated X.25 bridge. Unfortunately, the bridge software uses more than 300K of RAM, leaving little room for applications. I can't seem to find a way to load the bridge software into high or extended memory even under DR DOS 5.0. Can you make any recommendations?

Rafaela Valente

Lisbon, Portugal



The most interesting part of this letter was the idea of using Digital Research's DR DOS 5.0 to gain a big boost in available RAM. I'm sure legions of DR DOS users will write to affirm the ability of this operating system to save space on Novell client PCs.

Unfortunately, I can't help solve your problem with the X.25 bridge. My best advice is to dedicate the 286 to the bridge software. Anyone using that PC to run applications wouldn't be happy with the performance, so it's not worth the effort.

PROTECTING YOUR NETWORK

The letters you published on UPS systems struck a chord. Our power source is usually very good, with only rare interruptions of much less than a second. However, we noticed that our file server sometimes forgot what it was doing if we got a power fault in the middle of a print job. We saw no need for a 20-minute backup capability, so we found an inexpensive UPS we thought would do the job.

After we installed the UPS, the server still occasionally "forgot," but at least it no longer required a reboot. Our dealer helped us monitor the power source and we discovered that every time the line voltage dropped to 107 volts, the UPS would kick in, delivering a sizable spike to the server. However, further investigation confirmed what you reported in your November 27, 1990, UPS review: Our server runs fine at 95 volts.

We finally solved our problem by buying another UPS—one that could be adjusted to kick in only when the line voltage drops to 95 volts, not before. Even then we had to install a surge suppressor between the UPS and server to handle the

spike created when the UPS kicked in.

We also experienced a failure of our parachute: The batteries in our UPS gave out without warning. We received a comparable replacement unit but still lost operational time to dead batteries.

My experiences tell me two things about UPS systems and power sources. First, even if you think you have stable power, you still get interruptions, and even interruptions less than a second in duration cause problems. Second, you need adequate surge protection at the PC or server.

Phil Mishler

Sacramento, California



As your letter also reveals, having a "hair trigger" on your UPS is not a good thing. The batteries in a UPS are stressed every time it comes online. If this happens too often—and happens easily when you're protecting PCs with relatively rugged power supplies of their own—then the batteries drain very quickly. What you need is a UPS system that allows you to control parameters like turn-on voltage from software running on your PC, such as Elgar Corp.'s 480-watt IPS/A.I. 600.

Elgar's *LanSafe A.I. Plus* software runs on one DOS- or OS/2-based PC and allows you to monitor battery status, adjust parameters, and see a history of UPS devices around the network. The screen displays are spectacular, and administrators can view the status of UPS devices across bridges and routers. So from a single point at the corporate headquarters, someone with a knowledge of the finer points of UPS management can adjust the high- and low-voltage turn-on points and manage a complete battery replacement program for individual UPS devices on a nationwide network. Since good power is vital, Elgar's move to provide single-point UPS management for the total network is very smart. Contact Elgar at 619-450-0085 for details.

NETWORK YOUR QUESTIONS

Connectivity gives you practical solutions to networking problems of all types. We'll pay \$50 for any tip we print. Please submit your letter on a disk along with a printout. Mail your contribution to Connectivity, *PC Magazine*, One Park Avenue, New York, NY 10016, or you may contact Frank J. Derfler, Jr., via MCI Mail (be sure to use Derfler's box named PC MAGAZINE LAN LABS). We are unable to answer letters individually. ■

PC Magazine's Direct Marketing Connection for PC Products and Services



Most of you buy PC products and services through direct marketing channels. In fact, in a recent study of subscribers, 83% said they bought PC products from direct marketers.*

You buy direct because you know exactly what you need and you seek good value and fast delivery.

The following special section connects you with the direct marketers who are eager to please you. By having them all in one place, you can quickly zero in on what you need and which vendor you want to call.



JUST FOR BUYERS WHO MEAN BUSINESS.

FastData 386 Systems



FastData 386/33 \$1899

The fastest 386 processor available combined with a 64K thirty nanosecond memory cache make the FastData 386/33 a power users dream! Included in the base price is a 105 megabyte 17millisecond hard disk, 1024 by 768 VGA monitor and card, four megabytes of memory, and 5.25" & 3.5" high capacity floppy drives. Plus, should anything ever go wrong with your FastData computer, you are covered by a one-year warrantee with free on-site service or system replacement if we cannot correct the problem with our FastSHIP advance parts replacement program.

Standard Features

- ✓ 33mhz Intel 386-DX processor.
- ✓ 64K high-speed memory cache.
- ✓ 4 megabytes high speed RAM.
- ✓ 105 mb 17ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" and 1.44mb 3.5" floppy drives.
- ✓ Standard chassis (shown) or mini-tower with speed, keylock and reset buttons.
- ✓ 387-DX coprocessor socket.
- ✓ 230 watt power supply.
- ✓ 14" Super VGA color monitor, 1024x768 resolution, with 16 bit VGA card with 1mb Video Ram.
- ✓ Clock calendar, parallel port, game port and two serial ports.
- ✓ Keytronics 101 key keyboard.
- ✓ 8 expansion & 5 drive bays.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ MS-DOS 5.0.
- ✓ Windows & Mouse add \$69.
- ✓ FCC Class B approved.

386/DX33	80mb	100mb	200mb	660mb
Mono	\$1,529	\$1,599	\$1,849	\$3,199
Mono VGA	\$1,629	\$1,699	\$1,949	\$3,299
VGA 1024i	\$1,829	\$1,899	\$2,149	\$3,499
VGA 1024ni	\$1,929	\$1,999	\$2,249	\$3,599



FastData 386/25 \$1699

The optimum combination of features, expandability, and power make the FastData 386/25 an ideal choice for those whose applications demand high speed 32 bit processing and expandability. The value of the 386/25 goes far beyond its price; it comes configured with a full four megabytes of fast RAM, a quick 18 millisecond 80 megabyte hard disk, and maximum VGA displaying 1024 by 768 resolution powered by a high-output 16 bit 1mb VGA board. Also, the FastMicro team will configure your FastData 386 exactly the way you want, without sending you shopping elsewhere.

Standard Features

- ✓ 25mhz Intel 80386-DX.
- ✓ 4 megabytes of high speed RAM.
- ✓ 80 mb 18ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" and 1.44mb 3.5" floppy drives.
- ✓ Standard chassis or mini-tower (shown) with keylock, speed and reset buttons.
- ✓ 80387-DX coprocessor socket.
- ✓ 200 watt power supply.
- ✓ 14" Super VGA color monitor, 1024x768 resolution, with 16 bit VGA card with 512K.
- ✓ Clock calendar, parallel port, two serial ports, and game port.
- ✓ Keytronics 101 key keyboard.
- ✓ 8 slots & 5 drive bays.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ MS-DOS 5.0.
- ✓ Windows & Mouse add \$69.
- ✓ FCC Class B approved.

386/DX25	80mb	100mb	200mb	660mb
Mono	\$1,399	\$1,469	\$1,719	\$3,069
Mono VGA	\$1,499	\$1,569	\$1,819	\$3,169
VGA 1024i	\$1,699	\$1,769	\$2,019	\$3,369
VGA 1024ni	\$1,799	\$1,869	\$2,119	\$3,469



FastData 486/25

Call about our hot 486, now just \$2,399 with 4mb RAM, Super VGA & 100mb drive. Includes a 128K two-stage cache and is expandable to 64mb of memory.

All FastData Systems Include:

- 30 day money-back guarantee
- Toll-free technical support for life
- One year warrantee with on-site service available to most U.S. locations

FastData SX Systems



\$1499 FastData SX/20

25% faster than a 16mhz SX, the FastData SX/20 adds even greater performance to its 386 multitasking capabilities. Just \$200 more than our SX/16, this machine also includes an 80mb hard drive in addition to the super VGA color monitor and 16 bit VGA adaptor, Keytronics keyboard, DOS 5.0, and two floppy drives. The system includes two megabytes of memory and is expandable to eight on the main system board. Remember, when you have questions, need to solve a problem, or want recommendations on products for your system, the FastMicro team is standing by toll-free to provide product support for as long as you own your FastData personal computer.

Standard Features

- ✓ 20mhz Intel™ 386-SX processor.
- ✓ 2 megabytes of high speed RAM.
- ✓ 80 mb 18ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" and 1.44mb 3.5" floppy drives.
- ✓ Standard chassis (shown) or mini-tower with keylock, speed and reset buttons.
- ✓ 200 watt power supply
- ✓ 14" Super VGA color monitor with 16 bit VGA card with 512K.
- ✓ Clock calendar, parallel port, two serial ports, and game port.
- ✓ Keytronics 101 key keyboard.
- ✓ 8 expansion slots, 5 drive bays.
- ✓ 80387-SX coprocessor socket.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ Windows & Mouse add \$69.
- ✓ MS-DOS 5.0.
- ✓ FCC Class B approved.

386/SX20	40mb	80mb	100mb	200mb
Mono	\$1,069	\$1,199	\$1,269	\$1,519
Mono VGA	\$1,169	\$1,299	\$1,369	\$1,619
VGA Color	\$1,319	\$1,449	\$1,519	\$1,769
VGA 1024i	\$1,369	\$1,499	\$1,569	\$1,819



\$1299 FastData 386/SX

Combine the benefits of an advanced Intel 386 processor, the value of a 286 and the advantages of FastData and you've got the FastData 386/SX! This machine is the choice of those who want to run today's powerful 386 and multitasking software, like Windows, and also want to run their favorite DOS applications at surprising speeds. We've made our customers' favorite options standard: it comes with an ample two megabytes of memory, a high performance 40mb hard drive, and 16 bit super VGA. Compare performance, features, and service and you will find no better SX value. Interested further? Try the FastData 386/SX for 30 days; you have to be happy - if not, we'll take it back.

Standard Features

- ✓ 16mhz Intel™ 386-SX processor.
- ✓ 2 megabytes of fast RAM.
- ✓ 40 mb 28ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" and 1.44mb 3.5" floppy drives.
- ✓ Standard, mini tower, or mini desktop (shown) chassis with keylock, speed and reset buttons.
- ✓ 200 watt power supply
- ✓ 14" Super VGA color monitor with 16 bit VGA card with 512K.
- ✓ Clock calendar, parallel port, two serial ports, and a game port.
- ✓ Keytronics 101 key keyboard.
- ✓ 8 expansion slots, 5 drive bays.
- ✓ 80387-SX coprocessor socket.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ Windows & Mouse add \$69.
- ✓ MS-DOS 5.0.
- ✓ FCC Class B approved.

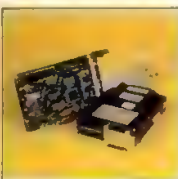
386/SX16	40mb	80mb	100mb	200mb
Mono	\$999	\$1,129	\$1,199	\$1,449
Mono VGA	\$1,099	\$1,229	\$1,299	\$1,549
VGA Color	\$1,249	\$1,379	\$1,449	\$1,699
VGA 1024i	\$1,299	\$1,429	\$1,499	\$1,749

FASTMICRO

For information or to order call:
1-800-441-FAST

DISK DRIVES

Colorado DJ-10 40-120mb Int. Tape	239
DJ-20 80-240mb Int. Tape	299
Conner (see FastData IDE controllers at right)	
CP3044 40mb IDE 28ms	199
CP3104 100mb IDE 25ms	349
CP3208 200mb IDE 25ms	599



Seagate 89mb AT Kit \$319

IDE performance, big 89 megabyte capacity and Seagate quality make this kit a great buy. A 19ms access time and 5 mbps transfer rate assure great performance. Controller, cables and rails are included to make installation fast and easy.

Irwin SX Int. Tape 40-120mb / 80-250mb	249/349
SX Ext. Tape 40-120mb / 80-250mb	399/499

Micropolis

MC1664 340mb ESDI 14ms	1295
MC1598 1.2gb SCSI 14ms	2695

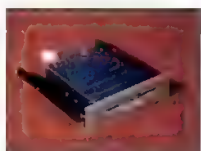
Plus Development

HardCard IXL 50 - 52mb 9 ms 16bit	399
HardCard IXL 105 - 105mb 9 ms 16bit	579

Toshiba 1.44mb

Floppy Drive \$59

Complete with mounting brackets and installation instructions, this Toshiba works in all true 286 & 186 compatibles. Well also read/write/format 720K 3.5 disks. Rails add \$5.



Seagate	
30MB XT Kit ST238 w/ cont.	249
40MB AT ST251-1 MFM Drive	229
40MB AT ST157A 28ms IDE Drive	179
80MB AT ST296N SCSI Drive w/adaptor	319
89MB ST1102A 19ms IDE Drive	299
125MB ST1144A 19ms IDE Drive	399
210MB ST1239A 15ms IDE Drive	599
330MB ST2383E 16ms ESDI Drive	1199
Sun Moon Star Ext. CD-ROM Drive Kit	449
Teac	
1.2MB 5.25" Floppy	65
1.44MB 3.5" Floppy	65



Toshiba 100mb IDE Kit \$369

Upgrade your 286 or 386 to IDE technology and Toshiba quality at a FastMicro price. This kit comes with a fast 20ms 100mb drive and built-in 11 controller, 16 bit IDE card with dual floppy controller and cables, 5.25" brackets and rails.

Toshiba	
360K 5.25" Floppy (Black)	59
1.2MB 5.25" Floppy	59
1.44MB 3.5" Floppy	59
65mb MK134 22ms RLL drive	279
100mb MK234FCH IDE 3.5" drive	349

Western Digital

WD93044 40mb IDE 28ms	199
WDAC280 80mb IDE 20ms	299
WDAP4200 200mb IDE 20ms	649
WE100TV SE2 ESDI AT 1.1 dual controller	149

Sony CD-ROM Drive \$379

ATI-adapted CD-ROM technology is here. This player reads over 600mb from just one CD and can even play your favorite audio CDs. This internal unit works on 386 thru 486 PCs regardless of hard drive type and comes with cable & interface. Add an Encyclopedia Book of Mammals or game CD for \$9 each.



BOARDS

Artisoft/Lantastic

Lantastic 2mbps Starter Kit - Two Station	349
Lantastic 2mbps Adaptor	139
Lantastic Ethernet Starter Kit - Two Station	499
Lantastic Ethernet Adaptor	209

ATI

2400 ETC Internal / External	129 / 159
8514/Ultra-VGA 1mb	599
9600/E External MNP V.42bis	369
VGA Basic 16	75



Sound Blaster \$149

Sound Blaster does for sound what VGA does for graphics! Supported by the largest software library, Sound Blaster make your games come to life. Also includes a music synthesizer, voice input and sound compression, and MIDI interface. SB Talker even converts text into spoken English. Includes a game port also.

VGA Wonder + 256K / 512K	159 / 189
VGA Wonder XL 256K 1mb	159 / 269
Brown Wagh Sound Blaster	149

Everex

2400B Int Modem	69
EGA 480 Card	69
RAM3000 16 bit - w/OK, add \$60/m max 3mb	75
RAM8000 16 bit - w/OK, add \$60/m max 8mb	169

Hayes

JT FAX 4800B Internal	139
Personal Modem 2400 w/Prodigy	119
Hercules Graphic Card +	169

Intel

Classic 2400 Modem Int. / Ext	139 / 169
Satisfaction Classic - Internal 9600	379
287XL	85
387-DX25 or 33	209
387-SX16 / 20	129 / 139

Logitech

ScanMan 32 / Catchword Bundle	165 / 199
ScanMan 256 for Windows	279

Orchid

ProDesigner II 1mb	279
Tiny Turbo 286	129
Tiny Turbo Xtra	269

ATI 9600ETC-E \$369

ATI delivers speed and accuracy with the 9600 ETC-E! It includes V.42, LAP-M, and MNP error correction combined with MNP/5 and V.42 bis data compression to provide total high speed throughput. It features automatic line speed correction, synchronous/asynchronous communication and automatic feature negotiation with connecting with other modems.



Paradise

Basic VGA - 8 bit	99
VGA 1024 256K/512K	149 / 179

Practical Peripherals

2400B Int Modem	125
2400B Int with MNP	159
PM9600SA Ext. V.32/V.42bis	449

USRobotics

2400 Sportster Int. / Ext.	119 / 135
2400 Sportster MNP Int. / Ext.	159 / 189
Courier HST 14,400 Int. / Ext.	539 / 579
Courier HST 14,400 Dual Standard Ext	839

Video 7

VGA 1024/256K / 512K	159 / 189
V-RAM II VGA 512K	339

ZOOM

HC2400 Internal	69
2400 V.42bis External Modem	159
9624 Send Receive Internal Fax Modem	119



MONITORS

Mitsubishi	
1410 EGA	325
Diamond Scan 1381	499
NEC	
Multisync 2a	469
Multisync GS 2a	199
Multisync 3d	629
Multisync 4d	949
Panasonic C1381 VGA	369
Seiko CM1440, 1450	499 / 639
Sony 1304 Multiscan	669
Zenith 1492	599

FastData Products

FastData 16 Bit VGA

The FastData 16 bit VGA card features 256K of video memory, does CGA, EGA, & VGA up to 1024x768 and comes with drivers for popular software including Windows 3.0. It's expandable to 512K and has a 30 day money-back guarantee.

\$79
\$99



FastData 16bit 1mb VGA	119
FastData CGA Card	35
FastData MGP Card	29
FastData Parallel Dual Serial/Game Card	29

FastData 2400 Baud Internal Modem

The FastData 2400 baud internal modem is fully Hayes compatible and can be configured to COM port 1-4. It has an internal speaker, auto answer & auto dial, and comes with communications software.



9600B Send/Fax w. 2400B Modem	99
9600B Send/Receive Fax w/2-100B	119
IDE 16 Bit 1.1 Hard/Floppy Disk Cont	29
RLL 16bit 1.1 Hard/Floppy Disk Cont	59
XT 1.44 Dual Floppy Controller	35

FastData Monitors

Your best value, guaranteed! We have a full line manufactured for us by manufacturers like Hyundai and Matsushita (Panasonic). As with all FastData branded product, you get a full 30-day money back satisfaction guarantee. Shown is the VGA color.



FastData Monitors

14" Amber or White Monochrome	99
14" White VGA Monochrome	119
14" CGA Color 52 dot pitch	199
14" VGA Color 31 dot pitch	279
14" Super VGA 1024 x 768 28 dp	319
14" Non-Int VGA 1024 x 768 28 dp	429

PRINTERS

Canon BJ10E	319
BJ300 BJ330	459 / 599
Citizen	
200GX / GSX-130	189 / 249
GSX140+ / GSX145	295 / 395
Fujitsu DL3400	359



Citizen GSX-140+ \$299

The new version of the "best-seller" it now comes with 8 resident fonts, paper parking, and a two year warranty. It does up to 220 CPS and has a new enhanced LCD control panel that lets you see everything without DIP switches. Upgrade to color anytime for just \$45.

NEC	
P3200	269
P3300	369
P6200 / 6300	469 / 629
OKIDATA Okilaser 400	669
Panasonic	
KXP1180	155
KXP1123	239
KXP1124i	299
KXP1624	379
KXP4420 Laser	829
KXP4450i / 4455 Lasers	1299 / Call

Texas Instruments

MicroLaser PS17 \$1199

PostScript laser printing has never been so affordable before. The TI PS17 includes 1.5mb of memory, genuine PostScript by Adobe, and 17 standard fonts including Times, Helvetica, Courier and Symbol. It handles paper up to 8.5 x 14 and envelopes too!



Seiko Smart Label Printer Plus	167
Star	
NX1001	149
NX1500	299
NX2410 / 2415	249 / 369
NX2410 / 2415	419 / 539
Texas Instruments MicroLaser PS17	1199
MicroLaser PS35	1499



FastData 286/12 \$699

Imagine a fast 286 computer at a super price and you've got the FastData 286/12. This system is complete, not stripped. You get one megabyte of zero-wait-state memory and a 28ms IDE hard disk - standard. Also included is an amber monitor and graphics card, your choice of a high density 1.2mb or 1.44mb floppy drive and a KeyTronic keyboard. And since it's a FastData, you are backed with toll-free technical support, one year warranty with the FastShip replacement program & on-site service plan, and our 30 day full money back satisfaction guarantee!

- ✓ 12mhz 80286 processor.
- ✓ 1 megabyte RAM.
- ✓ 40 mb 28ms IDE hard disk 1:1 interface.
- ✓ 1.2mb 5.25" or 1.44mb 3.5" floppy drive (2nd drive add \$59)
- ✓ Standard chassis (shown)
- ✓ Five drive bays.
- ✓ 200 watt power supply.
- ✓ Math coprocessor socket
- ✓ Monochrome monitor with monochrome graphic board.
- ✓ Clock/calendar, parallel port, game port, & 2 serial ports.
- ✓ KeyTronic enhanced 101 keyboard.
- ✓ 8 expansion slots, 6 available.
- ✓ MS-DOS 5.0.
- ✓ Full documentation.
- ✓ FCC Class B approved.

	40mb	80mb	100mb	200mb
Mon	\$999	\$1,079	\$1,149	\$1,149
Video VGA	\$999	\$1,079	\$1,149	\$1,149
VGA Color	\$999	\$1,079	\$1,149	\$1,149
VGA 1024i	\$999	\$1,129	\$1,199	\$1,449



DATABASE & FORMS

askSam 5.0	209
Avery List & Mail Plus	37
Clarion Personal Developer	45
Clarion Professional Developer	449
Clipper 5.01	489
DataEase	459
dBase III+	439
dBase IV	479
dBXL Diamond	129
Formbase	299
FormTool Gold	52
Formfiller	85
Foxbase Plus	179
FoxPro 2.0	449
Paradox 3.5	489
PerForm Designer & Filler	89
Personal Rbase	Call
Q & A	214
RapidFile	99
Rbase for DOS	447
Reflex	159

PerFORM PRO \$149

for Windows
PerForm Pro has all the advanced features for designing managing, filling, and printing high-end forms. By splitting the functions of designing and filling forms into separate Designer and Filler modules, PerForm Pro lets you maintain control of form design while you distribute form filling to every work station that needs it. Includes advanced security features, database links, multi-page forms, calculated fields, pre-designed templates and more.

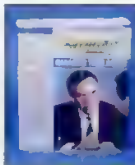


FINANCIAL

ACCPAC BPI Value Pak	359
ACCPAC Simply Acctg. for Windows	119
Bedford Integrated Acct	119
DAC Accounting 4.1	79
DAC Bonus Pack 4.1	119

Managing Your Money \$115

Andrew Tobias Managing Your Money is the on-personal financial manager that does it all! It writes and prints checks, organizes and tracks income and expenses, manages payables and receivables, prints invoices, organizes and estimates taxes, and analyzes financial needs, tracks and amortizes loans, manages your stock portfolio and more. Plus it includes an electronic rolodex & appointment schedule and can export data to 1-2-3 and tax prep programs.



Dollars & Sense	55
Managing Your Money	115
Money Matters	49
One Write Plus G/L, A/P & A/R	165
Pacioli 2000	35
Peachtree Complete III	139
Peachtree with Data Query	209
Quicken	36
The Manager's Organizer	139
Timeslips III	179
Wealth Builder	95

GRAPHICS

3-D Charts to Go for Windows	55
Autosketch 3.0	139
Corel Draw 2.0	359
Design CADD 3-D	185
DrawPerfect	259
Freelance Graphics 4.0	299
Generic 3D Drafting	199
Generic Cadd Level 2 Starter Kit	89
Generic Cadd 5.0	279
Harvard Graphics	299
PC Paintbrush IV Plus	109
Perspective Jr	69
PFS First Graphics	89

DESKTOP PUBLISHING

Adobe Postscript Cart. for HPLJ-II	299
Adobe TypeSet 1 or 2	57
db Publisher Professional	389
Express Publisher	Call
Pagemaker 4.0	489
PFS First Publisher	89



Pagemaker 4.0 \$489

The top desktop publishing software for Windows just got better. Version 4.0 adds story editor, a built-in word processor and spell checker. Pagemaker's advanced text manipulation and color design tools gives your publications a professional look. New Table Editor lets you create dynamically linked tables and graphics can flow automatically with text. Also includes Adobe Type Manager for Windows as a bonus.

PrintShop	33
Publisher's Paintbrush	279
PrintShop II	129
Ventura Publisher Gold / Windows	519

Visual Basic for Windows \$125

You've heard about it, now you can take advantage of this powerful and easy to use development system for Windows. Microsoft's Visual Basic contains a palette of visual tools to design and develop true Windows applications. It includes an interpreter to run your applications as you develop them, and a compiler to turn them into royalty free EXE files. Also includes debugging tools and sample applications you can modify.



Utility Software

Address Book Plus	39
Calendar Creator Plus	39
Central Point Backup	79
Checkit	79

MS-DOS 5.0 \$55

The new Microsoft DOS 5.0 frees 45K or more for DOS on 286 & 386 PCs. It includes a new Shell, I, delete and I, format, new Editor and more. Also includes Obasic, Command Line Help, new Backup and Windows enhancements. Plus, you can install it on your drive without reformatting, even on Networks. This official upgrade pack requires that you simply have an older command.com on your drive!

Company Ladder	45
Control Room	69
CoreFast	60
Carbon Copy Plus	105
Desqview	75
Desqview 386	125
Direct Access	57
Disk Manager Dos / Novell	36
Disk Optimizer	37
DR DOS 5.0	Call
GoScript 3.0	89
Fastback Plus	109

Stacker \$79

Stacker doubles the capacity of your hard disk in minutes, without reformatting. It compresses files in the background transparently giving you the extra room you need. For higher performance, Stacker software with coprocessor card (\$139) is an easily installable hardware solution which gives your hard disk a new lease on life.



Headroom	59
InfoSpotter	45
Labels Unlimited	45
Laplink III	85
Mace Utilities 1990	88
Mace Vaccine	59
Microsoft Learning DOS	32
MS DOS 5.0	55
Norton AntiVirus	79
Norton Backup	90
Norton Commander	90
Norton Utilities 5.0	109
PC Anywhere IV	95
PC Tools Deluxe 7.0	99
Personal Lawyer	34
P.D. Queue	55

PC Tools \$99 Deluxe 7.0

New PC Tools 7.0 is the perfect set of utilities for DOS 5. Includes new application menu system, remote operation of another PC, advanced data recovery and an enhanced backup in DOS and Windows versions. Anti-virus, which recognizes over 400 known viruses and even detects unknown ones is included as a free bonus.



PFS: Preface	47
Pop Drop Plus	53
PrintRite	55
ProComm Plus	65
Prodigy	25
QA Plus	85
QEMM 386	59
GRAM	49
SideKick Plus	119
Sideways	55
Smartcom Exec	69
Software Carousel	49
Super PC Kwik	43
XTree Gold 2.0	89

CIRCLE 352 ON READER SERVICE CARD

INTEGRATED

First Choice	95
Framework XE	95
Geoworks Ensemble	115
LotusWorks	89
SmartWare II	417
Symphony 2.2	489
Works	89

MICE/INPUT

Key Tronic 101 Keyboard	59
Key Tronic Professional Mouse	59
Logitech Mouseman Serial righthand	65
Logitech Mouseman Serial w/Windows	127
Logitech Mouseman Bus righthand	76



Logitech MouseMan Serial \$65

Logitech's MouseMan is the next step in mouse evolution. Specifically tailored in left or right hand versions, it provides maximum comfort and 400 DPI hardware resolution. Includes MouseWare utilities and Lifetime Warranty. Specify right or left, for PaintShop add \$15.

Logitech Mouseman Cordless	129
Logitech Trackman Serial	75
Microsoft Serial or Bus Mouse only	83
Microsoft Serial or Bus w/ paint	95
Microsoft with Windows 3.0	147
Z-Nix Serial Mouse w/Windows 3.0	89

PROGRAMMING

Macro Assembler	95
Microsoft C Compiler	303
Borland C++	299
Borland ObjectVision for Windows	89
Turbo Pascal Dos/Windows	90
Quick Basic	60
Quick C or Quick Pascal	60
Visual Basic for Windows	125
Windows Developer's Kit	309

SPREADSHEETS

Altways	115
Excel for Windows	299
Lotus 1-2-3 version 2.2	325
Lotus 1-2-3 version 3.1	399
Lucid 3-D	53
Quattro Pro 3.0 Upgrade	119
Supercalc 5D	89

Lotus 1-2-3 2.3 \$325

The powerful spread sheet that runs on any PC. New WSIWYG display, mouse support, 200 graph types, drawing tools and other graphics features to make spreadsheet publishing a breeze. Release 2.3 also adds auto-compress printing, another file viewer, context sensitive help, print preview and more. Call us for upgrade information too.



WORD PROCESSORS

Facellit for WordPerfect	57
Grammatik IV	55
LetterPerfect	119
Multimate 4.0	267
Professional Write	159
Publisher's PowerPak / WordPerfect	call
Rightwriter	55

WordPerfect 5.1 \$239

WordPerfect is the #1 rated word processing software. Its got almost every feature imaginable and yet it's easy to use. The current version adds mid-down menus, mouse support, table creation and equation editor. Add this to the best software support in the business and you can't go wrong!

Sprint	117
Word	209
Word for Windows	299
Word Perfect 5.1	239
Word Perfect for Windows	269
Word Perfect Add'l Station	159
Word Perfect Office	89
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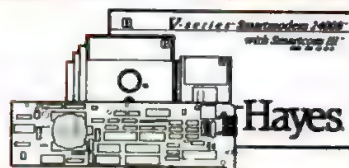
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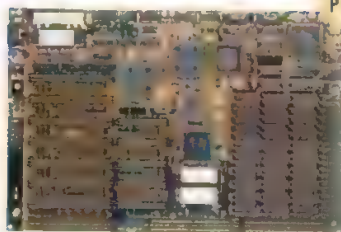
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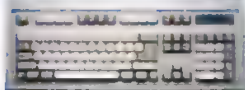


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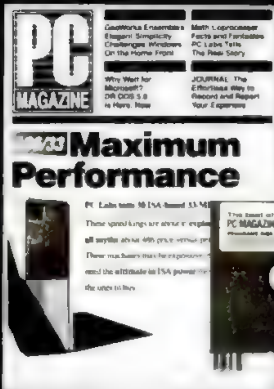
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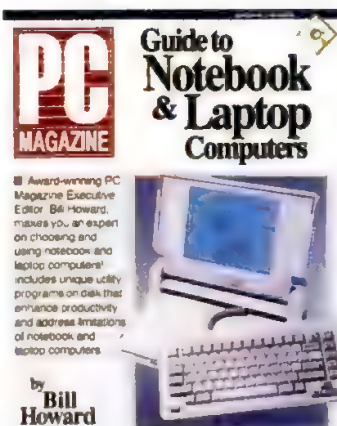


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This is the ultimate connectivity handbook, written by the director of PC LAN Labs and the author of *PC Magazine's* "Connectivity" column. The book/disk package includes practical, lab-tested advice on hardware and software products.

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by
Joe Salemi

Advisor

Help for Readers Making Personal Computer Decisions

ADDING MEMORY TO A 386

I would like to increase the amount of memory in my CompuAdd 386 PC. It came with 1MB of 256K chips and I would like to replace them with 4MB of 1MB SIMMs. I had read in a past Pipeline column that 1MB SIMMs have dropped in price. I called up CompuAdd and they charge almost \$100 per megabyte. It seems like others are charging from \$50 to \$60. Are they proprietary? Can I purchase the cheaper SIMMs from somewhere else and mount them myself? If so, where?

Nicholas Tea
Long Island City, New York



You can definitely save money by shopping around and buying the memory from someone other than CompuAdd. All computer manufacturers charge a stiff premium for memory upgrades; many charge far more than CompuAdd is asking. It's not unusual to find PC makers asking \$200 a megabyte.

If you buy through a memory distributor, you should have no problem finding SIMMs at \$60 a megabyte for 70-nanosecond performance. Slower memory (90 nanosecond) is selling for as little as \$40 a megabyte as of this writing.

Replacing SIMMs is easy, after you've had a little practice. Just go slow the first time. The SIMMs are held in place by tiny plastic clasps that break easily. Follow the directions that come with the chips very carefully. If one of the plastic clasps does break, you could crack the plastic housing that keeps the metal connectors in place—a problem that can be fixed only with a motherboard replacement.

Don't let this dissuade you from doing your own upgrade; it's a simple job that can save you a bundle of money, just as long

- **ADDING MEMORY TO A 386:** Is it okay to add memory to your PC yourself?
- **PERSONALITY SURVEYS:** Can the standard personality tests be automated?
- **ONE-PASS DISKCOPY:** Why does DISKCOPY make you swap disks so many times?
- **SPANISH TRANSLATIONS:** Can documents be translated to different languages on the PC?
- **CHOOSING A HARD CARD:** Is the data safe when the PC is turned off?

as you use plenty of care.

Without knowing the exact model number of your CompuAdd, I can't tell you which SIMMs to buy. The timing used in your machine limits you to a handful of choices (and determines whether you must use slow chips or can upgrade to faster chips). CompuAdd has designed many 386 models over the years and so the exact specifications of your machine will need to be known before you can choose the right SIMMs.

As a general rule, computers that come with 256K SIMMs can run either 256K or 1MB SIMM packs, but that's not always the case. Your manual may detail which types of chips can be used as an upgrade, or you can call CompuAdd's technical support line and ask for a list of acceptable replacements.

If you can't get the information either of these ways, copy down the name and model number of the chips installed in your system so you can ask chip vendors for acceptable alternatives.

Look through the Classified section of this magazine. You're sure to find several companies that sell memory upgrades. Their sales representatives are usually very knowledgeable and may be

able to tell you which SIMMs will work.

And, of course, make sure the company is prepared to refund your money if the chips don't work out. Don't be hesitant to accept their advice on an acceptable substitute that wasn't mentioned by CompuAdd. It's quite common for manufacturers to provide only a limited list of alternatives. A manufacturer may have been using only Toshiba chips at the time it designed and tested a particular model, even though NEC and NMB parts are completely compatible. Chip vendors are more likely to have comprehensive information.

PERSONALITY SURVEYS

I have taken a few classes in personality evaluation methods. Most manual methods require the interviewer to give the interviewee a questionnaire. This questionnaire asks questions about how the interviewee feels "others feel to him or her" and how "he or she feels to him or herself." Then manual calculations have to be done to get to a personality profile. Are there similar computer-based programs that would take out the manual steps?

Joseph S. Zemel
Boothwyn, Pennsylvania



Compiling data is what computers are good at; the first computers were designed to relieve the drudgery of manually counting the replies to U.S. Census Bureau census forms.

Personality surveys, which usually consist of multiple-choice questions and answers, are a ripe area for the development of programs that reduce the manual calculations involved in the analysis. A couple of companies have designed products to fill this need.

Profiles International Inc. (Bedford, Tex.; 817-354-1704), has two programs designed for personnel management and human resource evaluations. *Profile* (\$650 to \$3,900) has six mental attitudes and ten personality dimension surveys for evaluating current and potential employees.

Profile Stability Series (\$1,500) rates an employee's job stability through the assessment of ten personality traits.

For the evaluation of the sales ability of perspective employees, there's *Profile for Success in Sales* (Psychological Psoftware Co., Aptos, Calif.; 408-688-6808; \$200). This program uses 200 questions to help you evaluate 16 areas of personality and sales ability.

Another application aimed at human resource departments is *Individual Talent Survey* (Simple Software Inc., Charlotte, N.C.; 800-759-2677, 704-376-9091; \$2,500 to \$10,000). It also evaluates an employee's abilities, leadership potential, and motivations.

ONE-PASS DISKCOPY

Currently, I own a 386SX computer with 2MB on-board, but when I use DISKCOPY to duplicate a 1.44MB disk, I need to swap the master and the copy disks each three times to

Advisor

complete the job. Why?

Are you aware of any ways or any utility software that supports DISKCOPY without swapping the disks that many times?

D. Nguyen
Irvine, California



The DISKCOPY that comes with DOS is basically dumb. It works on the assumption that your system is the least capable system available—one floppy drive, no hard disk, and only DOS RAM. It doesn't use extended or expanded (EMS) memory, and doesn't know how to use a hard disk to store an image of the disk prior to copying it. So it's limited to available DOS memory, which is a maximum of 640K minus the RAM taken by DOS itself and any TSRs you may have loaded.

Simple math shows that even with the maximum available RAM, it would take three passes to make a full copy of a 1.44MB disk; the first two would copy 640K each, for a total of 1,280K, and the last pass would transfer the balance. This has been the situation since the early days of DOS, and utility programmers have filled the need for a smarter version of DISKCOPY.

Two such utilities can be found in Library 16/Other Utilities/Tips forum (see page 8 of this issue for information on joining PC MagNet). DISKDUPE (in the library as DSKDUP.ZIP) is a public-domain utility that uses space on the hard disk to store an image of the disk prior to making the copy; it also lets you make multiple copies of the same disk from the same image. Unlike DISKCOPY, DISKDUPE won't format the destination disk while doing the copy.

COPYQM (Sydex, Sunnyvale, Calif.; 408-739-4866; \$15) is a shareware utility that performs all the functions of DISKCOPY, and will also verify that the copy is correct, replicating the functions of the DOS DISKCOMP utility. COPYQM will format the destination disks if necessary, and uses EMS, extended memory, or the hard disk

to store the data for transfer. It will also let you keep a copy of the disk image on your hard disk, so that you can make duplicates when needed at a later time, and will even serialize the copies. COPYQM can be found under the filename COPYQM.ZIP.

When Microsoft and IBM wrote OS/2, with its ability to address 16MB of real RAM as well as virtual (disk) memory, it would have made sense to remove any limits from DISKCOPY, and let it use as much memory as needed to copy disks. They didn't, and the OS/2 version also requires multiple passes to do its work. DISKCPY2 is a public-domain OS/2 utility that does one-pass copies, and also lets you make multiple copies of the same disk. It can be found in Library 2 of the PROGRAMMING forum on MagNet, under the file name DSKCPY.ZIP.

SPANISH TRANSLATIONS

I work in a small office where the translation of articles and documents from Spanish into English is performed on numerous occasions throughout the day.

Would you happen to know of a software firm that markets a program capable of handling translations from English into Spanish, as well as from Spanish into English?

Michael Wulczyn
El Paso, Texas



There are several translation programs available for the PC, starting at \$79 and ranging to nearly \$2,000. All will do some translation—enough to cut down on the time needed to translate a document—though you'll still need workers who are fluent in Spanish.

The least-expensive program, the \$79 *Spanish Language Assistant* (MicroTac Software, San Diego, Calif.; 619-272-5700), will turn English into Spanish but it can't do the reverse. It has auxiliary tools, like a dictionary and a verb conjugator, and considering its low price it's probably the product you should evaluate first. See the review in First Looks, August 1991.

Translate (Finalsoft Corp., Miami, Fla.; 800-232-8228, 305-477-2703; \$495) includes an 85,000-word dictionary with a



Spanish Language Assistant translates documents only one way: from English into Spanish. With a list price of \$79, however, it's a good program to look at if you need help in translating documents. French, German, and Italian versions are available too.

menu-driven dictionary maintenance and customization program. It will translate line-by-line, or import an ASCII text file.

PC-Translator (Linguistic Products, The Woodlands, Tex.; 713-363-9154; \$985 per language) supports a number of languages besides Spanish—it also supports Danish, French, and Swedish. It supports multiple dictionaries of unlimited size, and allows you to create your own.

The third product is *GTS Globalink Translation System* (Globalink Inc., Fairfax, Va.; 800-255-5660, 703-273-5600; \$1,998). *GTS* also supports a number of languages, including French, German, Italian, Portuguese, Russian, and Spanish. It's primarily designed for scientific, technical, and legal material.

CHOOSING A HARD CARD

I'm now shopping for a new fixed disk and so I'm considering a hard card. Unfortunately, since I live overseas, I power my computer through a transformer. To save electricity, I unplug the transformer when not actually in use. Can I use something like Plus Development's HardCard, considering the above information?

Allen D. Evans
APO, New York



First, let me assure you that any hard disk on a card works exactly like

regular hard disks; when you turn your system off, the disk stops spinning, and you can safely unplug the system.

HardCards (Plus Development Corp., Milpitas, Calif.; 800-624-5545, 408-434-6900) have an extra measure of shock protection, and are more resistant to damage from physical shocks (such as bumping the system case) than regular hard disks.

The HardCard II 40 (\$539) is a 33-ms. 40MB hard disk compatible with all ISA systems (it uses an 8-bit slot). The HardCard II 80 (\$729) is a 25-ms. 81MB hard disk for AT and PS/2 30-286 systems (it requires a 16-bit slot).

About two years ago, Plus Development redesigned the original HardCards to take advantage of the 16-bit data path in AT bus-based systems (80286 and up); the result is the high-performance (17-ms.) XL Series. The XL50 (\$579) provides 52MB of additional hard disk space. The XL105 (\$999) will give you the 105MB of extra disk space you want.

ASK THE ADVISOR

Send your questions to PC Advisor, One Park Avenue, New York, NY 10016, MCI mailbox PC MAGAZINE, or upload them to MagNet (see the instructions for joining on page 8 of this issue). Sorry, but we cannot send personal replies. ■



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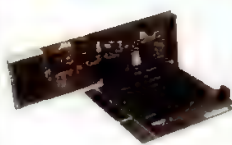
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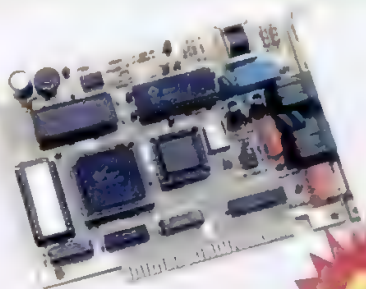
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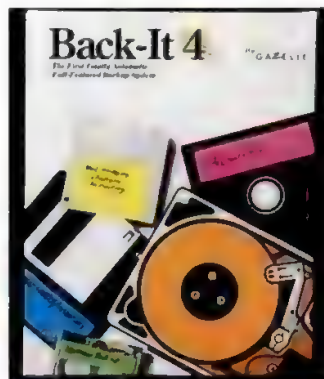
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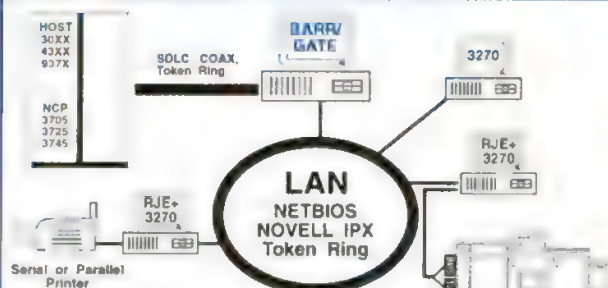
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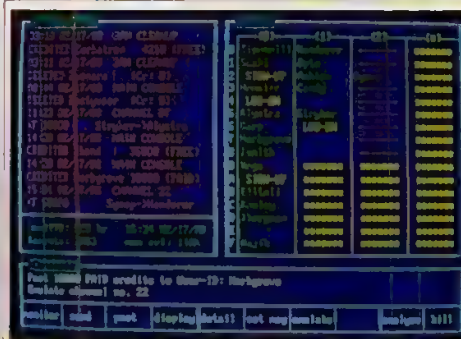
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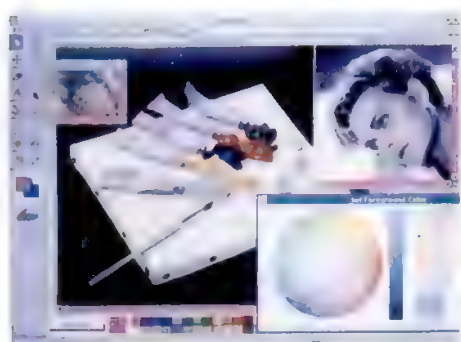


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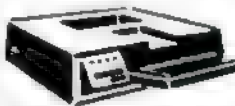
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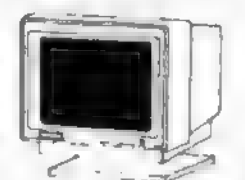
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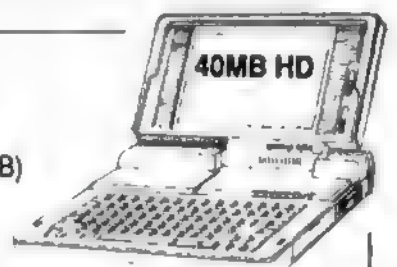
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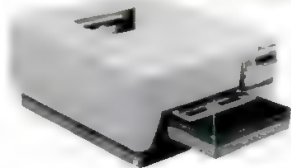
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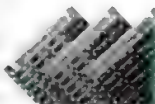
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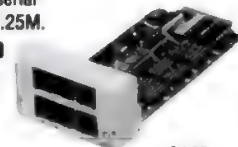
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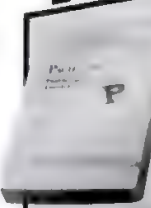


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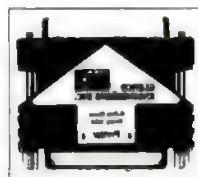
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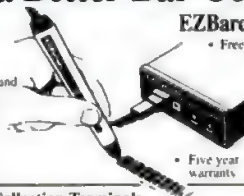
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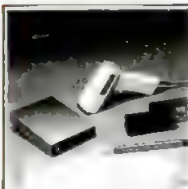
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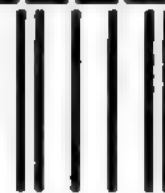
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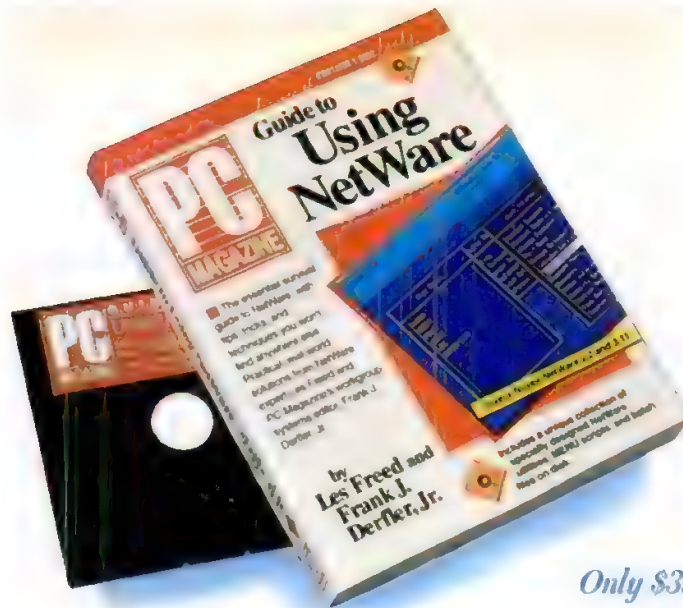
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■ DATA COMPRESSION UTILITIES

Contributing editor Barry Simon looks at six utilities for compressing and archiving files, including *ARC Plus* and *PKZIP*. They're not just for data transmission anymore.

■ SECURE PCs ON A LAN

The 14 secure PCs we review promise to shield your network from a variety of hazards. Systems with special "key-card" locks keep unauthorized users from accessing your important data; others without floppy disk drive bays make sure viruses won't infect your network. But just because some of these models are diskless doesn't mean they're lacking: All the machines we review come with both SX-class processors and a solid 4MB of RAM.

■ NETWARE 3.11

The Connectivity team looks over the latest and greatest from Novell. Our look at the newest version of the operating system will discuss how *NetWare 3.11* has been improved with features like TCP/IP support, and how it stacks up against *LAN Manager*. We'll also describe exactly what the requirements are for getting a system certified as a *NetWare* server, and we'll survey the differences between Version 3.11 and the recently released 2.2.

■ PORTABLE POINTING DEVICES



Laptop-toting road warriors want something smaller than desktop mice with shorter cords. Enter the portable pointing device. PC Labs tests nine mini-trackballs, dwarf mice, mouse-trackball combinations, mouse pens, palm-size joysticks, and related contraptions, from *Appoint*, *GRiD*, *IBM*, *Logitech*, *Microsoft*, and others.

■ FORMS SOFTWARE

Business and forms go hand in hand, for better or for worse. That's why you should consider one of these five forms creation/filler packages. If you need a new form every time you turn around, don't drown in paperwork—put it on your computer!

■ PRINTER ENDURANCE TEST

We took last year's printer blockbuster's Editors' Choice winners and put them to the ultimate test: 10 months of in-depth testing and hard-core use on a PC journalist's desk. See how the five best lasers, the seven best dot matrix printers, and the top two ink jets of 1990 are faring in 1991.

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MARKETPLACE PRODUCT INDEX page 461.

SEPTEMBER 24, 1991 PC MAGAZINE 495

After Hours

Products for the Leisure Side of Personal Computing

Disney Offers Print Kits And a Line of Inexpensive Early Learning Software

EDUCATION
by Don Trivette

You've been wanting to give a party, but you just can't find suitable decorations. Your search is over, because now there are two theme print programs from Walt Disney Software that create party paraphernalia.

Mickey & Minnie's Fun Time Print Kit lets you design and customize greeting cards, posters, banners, invitations, place

mats, and letterhead stationery—all with the famous Disney graphics. There's Mickey with a baseball, with a cake, in a cowboy hat, carrying a surfboard, conducting an orchestra, and mailing a letter, just to name a few. Minnie's activities are more feminine: She mails a valentine, waters flowers, and teaches school.

These figures, when combined with numerous borders and type fonts, are the raw materials

of *Print Kit*; from them, you can create a wide variety of printed output.

If Mickey Mouse isn't your favorite character, perhaps Rodent, Dick Tracy's arch-nemesis, is more to your liking. Rodent is just one of the characters you can print using—what else—*Dick Tracy Crime Stoppers Print Kit*. This bit of Disney tie-in software lets you produce invitations, wanted posters, masks, greeting cards, rap sheets, police badges, place mats, and a facsimile of Tracy's famous two-way wrist radio.

In addition to Rodent, the cast of characters includes Prune Face, Steve the Tramp, Itchy, Lips Manliss, and The Kid.

These print kits are similar to Broderbund's best-selling *Print Shop* but differ in that they include trademarked characters like Mickey, Minnie, and Dick Tracy. Both print kits run directly from floppy disks, which is a plus for those of us with saturated hard disk drives. Either could be used successfully by an 8- or 9-year-old, although in terms of subject matter and graphics, *Mickey & Minnie* is geared more for children. Both products support a wide variety of printers.

The folks at Disney Software have been busier than the Seven Dwarfs. In addition to print kits, they've introduced a new line of budget educational software for the preschooler. These \$14.95 programs offer many of the same features found in more expensive software—sparkling color, lively animation, and Disney characters; about the only thing missing is support for Disney's Sound Source module.

Donald's Alphabet Chase is my personal favorite. Alphabet "pets" have escaped from Huey, Dewey, and Louie's toybox and are roaming all over the house. As your child presses the key of the flashing letter, Donald finds

■ **EDUCATION**
Disney introduces print kits with familiar clip-art characters

■ **CD-ROM**
Lists-On-Disc: You may never use a conventional phone book again

■ **GAMES**
SSI's latest adventure is a feast for your eyes, ears, and mind.

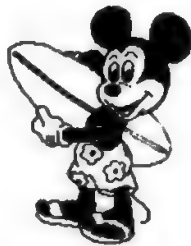
Dragon's Lair translates the work of a leading animator from the arcade to your screen.

The *Dick Tracy Crime Stoppers Print Kit* has images of characters from the popular comic strip and movie.

WANTED
THE
COMPUTER KID



JAMMIN TREY HALL



Mickey & Minnie's Print Kit includes artwork that lets you design greeting cards featuring popular Disney characters.

the cavorting runaway and places it at the top of the screen. I was enchanted with the antics of the letters. The C, for example, bounces around the living room and clings to an overhead light fixture until Donald finally captures it.

Mickey's Runaway Zoo is an adventure in numbers. Goofy left the gate open at Mickey's Petting Zoo, and all the animals got away. Your child gets to identify numbers in four scenes: a park, a city street, a residential neighborhood, and at the beach. When he or she presses the correct key, the animal emerges from hiding and goes to the zoo wagon. The quantity of animals corresponds to the number: For example, if a 3 is pressed, three parrots fly from a tree to the wagon.

CONTINUES

After Hours

Disney Print Kits

CONTINUED

Goofy's Railway Express teaches the preschooler to recognize shapes like rectangles, circles, and squares. As a train puffs its way around the countryside, it sends forth shapes from the smokestack. When the child presses the Spacebar—the only key used in this game—the shape turns into something. A half-circle, for example, becomes a turtle.

All of these Disney programs have one thing in common: reasonable price. It's a welcome trend and one we'd like to see many more publishers adopt for

educational software.

List Price: Mickey & Minnie's Print Kit, \$19.95; Dick Tracy Crime Stoppers Print Kit, \$19.95; Donald's Alphabet Chase, \$14.95; Mickey's Runaway Zoo, \$14.95; Goofy's Railway Express, \$14.95.

Requires: Mickey & Minnie's Print Kit: 512K RAM, DOS 2.0 or later, graphics monitor, printer. Dick Tracy Crime Stoppers Print Kit: 384K RAM, DOS 2.0 or later, graphics monitor, printer. Budget preschool series: 256K RAM (384K Tandy), color monitor, DOS 2.0 or later. Off-disk copy protection. Walt Disney Computer Software, 500 S. Buena Vista St., Burbank, CA 91521; 818-841-3326.

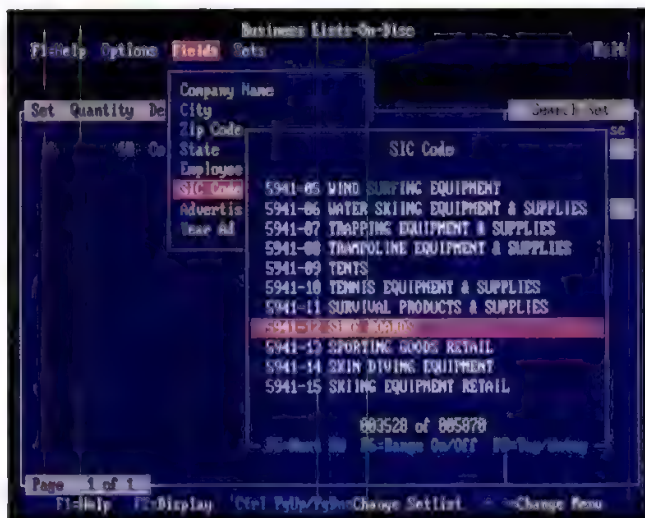
CIRCLE 425 ON READER SERVICE CARD

Lists-On-Disc Collects Business Phone Numbers And Puts Them on CD-ROM

Imagine a stack of yellow-page telephone directories for the whole country: more than 9 million listings occupying 200 feet of shelf space. Now, imagine being able to search through all those books in just seconds. That's what the Optical Products Division of American Business Information offers in its *Lists-On-Disc* CD-ROM.

Lists-On-Disc is a very fast

retrieval program that allows the user to search the database by company name, city, state, ZIP code, employee size, SIC code, and two entries peculiar to the yellow pages: advertising size and the year the ad first appeared. At the heart of the system are the government-assigned Standard Industrial Codes (SIC) that cover everything from tobacco growers (0132) to stair-tread manufacturers (9999). American Business Information has extended these codes by two to



Lists-On-Disc allows searches of its database according to several criteria, including SIC (Standard Industrial Classification) codes.

three digits to further refine and classify the data. All McDonalds' restaurants, for instance, are coded as 5812-08-K.

By combining SIC codes with states, cities, or ZIP codes you can quickly focus on a particular industry and geographical market. For example, to locate all restaurants in Zax, Oklahoma, you search the database by the SIC code 5812-08 and then search the resulting subset for the city name.

Output is available in a variety of forms, including a mailing-label format, a printed listing, a dialed telephone number for modem-equipped computers, or a download to a floppy disk. This last option is particularly valuable because *Lists-On-Disc* is priced on a per-name, per-use basis. By saving data to an ASCII file, you can reuse the information as often as you need but pay the per-record charge only once, when the file is created.

Cost accounting is done by a small plug that attaches to the computer's parallel printer port. The plug comes with the count set at 1,000; each time you print, dial, or download a name, the count is reduced. When the plug is "empty" you may purchase additional names in increments of 1,000 for 12 cents each; the software will not run without the plug or with a counter reading of 0. Screen viewing of names, however, is not charged to the plug and is therefore unlimited.

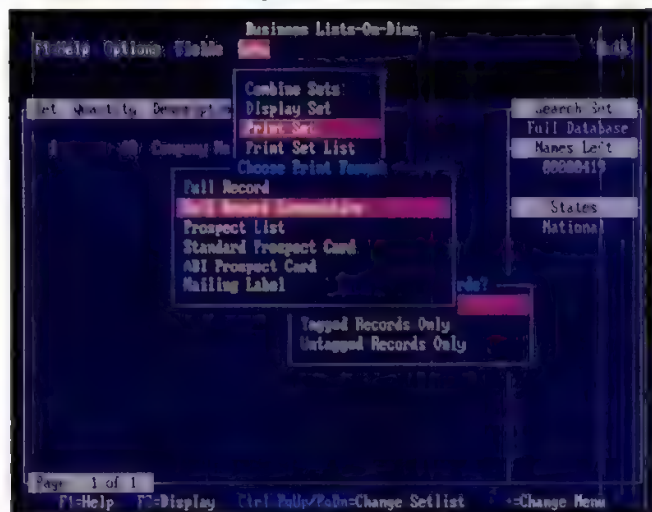
A product like this is only as good as its data. To ensure accuracy, American Business Information does its own data capture and preparation with a trained staff who constantly pour over yellow-page directories and professional listings. Where competing yellow pages are available for an area, the largest and best-established book is used. Updating is continuous, although new disks are produced only twice a year. In my limited testing, *Lists-On-Disc* located every firm I looked for.

The retrieval software is controlled by easy-to-understand pull-down menus. Although it lacks a few amenities like the ability to delete multiple subsets with one command, *Lists-On-Disc* is both intuitive and fast. It takes less than 10 seconds to search the database using a Sony CD-ROM drive and a 286 processor. Promoted as a desktop marketing system for the PC, *Lists-On-Disc* is a valuable tool for salespeople or anyone needing to locate companies.

List Price: *Lists-On-Disc*: annual license fee (includes 1,000 names), \$750. **Requires:** 640K RAM, hard disk, DOS 3.0 or later; CD-ROM drive, Microsoft 2.1 CD-ROM extensions. American Business Information Inc., Optical Products Division, 5711 S. 86th Circle, Omaha, NE 68127; 402-593-4565.

CIRCLE 426 ON READER SERVICE CARD

CONTINUES



Lists-On-Disc offers a variety of sorting options; a hardware cost-accounting device keeps track of your output.

After Hours

SSI Challenges Your Intellect and Your Senses in a New Game

by Barry B. Brown

Now you've done it! You're no longer hovering above the epic battles fought by your hand-picked team against endless dungeon foes: You're actually *there*. You're on the front lines, walking down a narrow, rubble-filled underground corridor that recedes into shadow. Water drips from above. Exceptionally deep drum beats sound slowly off to the right. Soft slithering noises scurry from the left, move behind you, then suddenly cease. You round a corner and come face to face with four tall, scowling ghouls. Even as you stand there, each raises a weapon, moving independently as they angle for the kill. A horrible battle cry bursts from one throat, and the wind whistles along their blades....

Welcome to SSI's *Eye of the Beholder*, the most ambitious implementation yet of multimedia in the computer gaming world. Its first-person, 3-D point of action puts you squarely on the fighting line. Your view is that of your party, up to six characters moving through the uniquely animated environment beneath the town of Waterdeep. Initially you seek a hidden criminal gang, but before long you find yourself entering a much older, deeper world of catacombs, one occupied by creatures who don't like surface dwellers (save with a dash of tartar sauce).

All of the familiar SSI gaming elements are here, but their presentation has been largely rethought. Portraits are more diverse and very distinctive, for example, and skills develop automatically during play. From the main screen, bar charts and icons in the graphical user interface display your health status and your selection of hand-held objects. You can click on or choose Inventory for a closer view of a character's possessions.

The artwork (using Electronic Arts' *Deluxe Paint*) is extremely well drawn. Although the game runs in both EGA and excellent 256-color VGA, a conscious decision was made to create two distinct sets of files, avoiding a compromise of either standard. Both benefit. Better than the art, however, is the animation. *Eye of the Beholder* treats each screen as a series of individual elements, rather than a single canvas. Each visible object is bitmapped, run simultaneously, and scaled on the fly.

More than 150 sound effects for the AdLib card were applied to the game, though they never draw attention to themselves: They serve only to enhance the fictional reality. If you toss a stone, it recedes in true 3-D perspective, landing several steps away with a hollow thud. Throw a dagger, and you hear the air movement; finally it clatters to the ground. Visuals and stereo separation, in turn, combine to simulate the uncanny effect of monsters sneaking around *behind* you. Add to this large doses of silence, and you have a sense of suspense Alfred Hitchcock would have appreciated.

Eye of the Beholder still needs a little fine-tuning, but that's only to be expected in any new gaming engine. This SSI role-playing fantasy possesses fewer subplots than most and little interaction with computer-driven personalities—save for the standard kill-or-be-killed option. Movement appears more restrictive, with only two of your characters participating in hand-to-hand combat in any given round. Transferring or identifying objects is impossible without first dropping them.

Finally, the command structure is biased against magic casters. Fighting requires only a good shot with a weapon, but casting a spell means opening a book, choosing the spell level, scrolling to that spell, and hitting Enter.



Eye of the Beholder uses graphics elements, such as icons and charts, to display your status as the game progresses.

Eye of the Beholder's graphics, which were executed with Electronic Arts' *Deluxe Paint*, give you a first-person view of the action.



It's slow, burdensome, and exceptionally dangerous.

These are minor points, however, in a bug-free product of advanced concept and realization. You can safely bet that if *Eye of the Beholder* design techniques had been used in some clever training demo for business software, computer columnists would already be heralding the arrival of multimedia maturity. Since it's featured in a game, however, and merely provides exceptional-quality entertainment, it will be ignored. Do

yourself a favor: Go out and buy *Eye of the Beholder*. You will be one up on the industry trendsetters, and with luck, by the time you reenter the post-game real world, the next release in this new SSI series will be available. **List Price:** *Eye of the Beholder*, \$49.95. **Requires:** 640K RAM, DOS 3.0 or later, graphics adapter. Supports AdLib and Sound Blaster cards. Strategic Simulations Inc., 675 Almanor Ave., #201, Sunnyvale, CA 94086; 408-737-6800.

CIRCLE 427 ON READER SERVICE CARD

Arcade Addicts Will Find Ample Challenge When Inside the Dragon's Lair

GAMES
by Don Trivette

Years before animator Don Bluth produced *An American Tail*, *The Land Before Time*, and *All Dogs Go to Heaven*, he created the first interactive laser disk video game. Anyone who was around in 1982 will surely remember the lightening-fast action of *Dragon's Lair*, which eventually earned about half a billion dollars—all in quarters. Now that

game, and a sequel not yet released in the arcades, is available for the PC.

The plot is the old knight-princess-wizard-dragon story: Princess Daphne must be rescued by Dirk the Daring from the clutches of Mordroc and his pet fire-breather Singe. If the plot sounds familiar, the action is like no other PC game you've ever played.

It should be easy to defeat

CONTINUES

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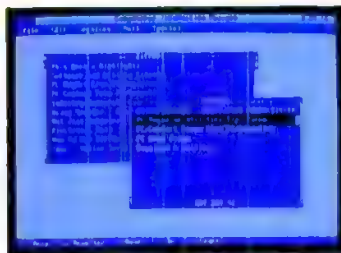
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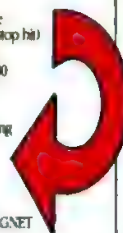


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2. **By Mail** - Write your name, address and ZiffNet/CompuServe ID Number on a 3" by 5" index card, along with the words "ZiffNet Modem Sweepstakes" and a time of day (e.g. "10:10 a.m." or "1:32 p.m."). Mail your entry to ZiffNet Modem Sweepstakes, 5000 Arlington Centre Blvd., P.O. Box 20212, Columbus, OH 43220. Your entry will be placed in the drawing if the time you selected has been pre-selected on the day we receive it. All entries become the property of Ziff Communications Company.
3. **Sweepstakes begins on August 7, 1991** - Your entry must be received if you are entering by mail before November 14, 1991. We reserve the right to print the names of the winners. The Sweepstakes will be promoted under the name of ZiffNet Modem Sweepstakes.
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- your mailed-in entry, you will be put into a drawing held each night of the Sweepstakes. Only one prize per household will be awarded.
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6. **Eligibility** - Sweepstakes is open to all individuals at least 18 years of age who are Members of ZiffNet or CompuServe (see enrollment instructions) and are residents of the United States, its territories and possessions, except employees of Ziff Communications Company and CompuServe, their affiliates, advertising promotion agencies, and sponsored accounts. Void where prohibited or restricted by law.
7. **List of Winners** - The names of all winners will be posted on the After Hours Forum. Or send a self-addressed, stamped envelope to: Modem Winners, ZiffNet, One Park Avenue, New York, New York 10016. A complete list of winners will be available on November 16, 1991.

After Hours

Dragon's Lair

CONTINUED

dragons, escape serpents, and avoid traps—after all, there are only five keys for the player to command: up, down, left, right, and fire. But easy is something these games aren't. In the first scene, it may take you two dozen tries to get across the drawbridge and into the castle.

Production values for *Dragon's Lair I* are inconsistent. The classic-style animation, for which Bluth is justly famous, couldn't be better; the EGA colors are good. But user friendliness is nil. The install program, for example, doesn't warn you if there's not enough space on your hard disk to store all seven diskettes. Want to save a game in progress? Forget it, *Dragon's Lair I* needed every last bit of memory—there wasn't any left

for a save feature. The only concession to friendliness is the three lives you get before having to start over.

Dragon's Lair II, subtitled *Time Warp*, is a sequel with the same characters and the same Bluth animation, but produced and distributed by a different software company. *Lair II* is more difficult to solve, and its production values are somewhat different. Graphics and animation are more spectacular than in *Lair I*, thanks to VGA graphics and the use of dithering techniques.

There's support for Sound Blaster and AdLib sound boards; there's even a very primitive save feature. But these enhancements gobbled up all the available memory, so there was no room for such conveniences as a software exit: It's reboot city when you are through playing.

Why would anyone pay big bucks for games that are so ill behaved? In two words: raw

Dragon's Lair II has VGA graphics and a crude save feature, but you must reboot when finished in order to leave the game.



challenge. Both *Dragon's Lairs* move at a speed that requires instinctive action; if you stop to think what to do next, you are dead. And if your timing is the slightest bit off, you are dead. Even my 13-year-old friend Rodney, a seasoned arcade professional if ever there was one, finds the Bluth adventures a real challenge. For the jaded arcader, this is champagne and caviar. ■
List Price: *Dragon's Lair I*, \$69.95. **Requires:** 640K RAM,

EGA graphics, DOS 2.0 or later; 286 processor and hard disk recommended. Merit Software, 13635 Gamma Rd., Dallas, TX 75244; 800-238-4277. **List Price:** *Dragon's Lair II*, \$59.95. **Requires:** 640K RAM; DOS 2.0 or later. CGA/EGA/VGA graphics; hard disk recommended. ReadySoft Inc., 30 Wertheim Ct., Unit 2, Richmond Hill, Ontario, Canada L4B 1B9; 416-731-4175.

CIRCLE 428 ON READER SERVICE CARD

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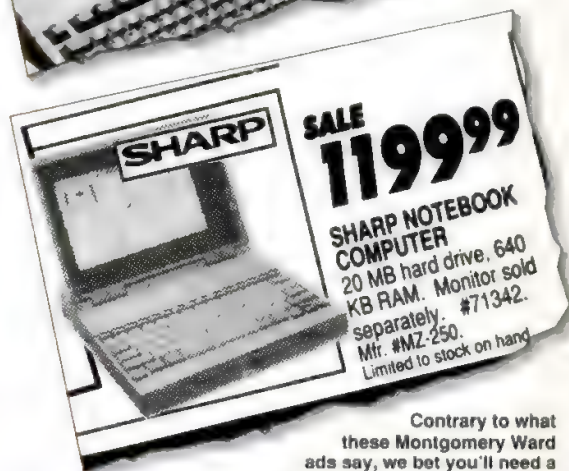
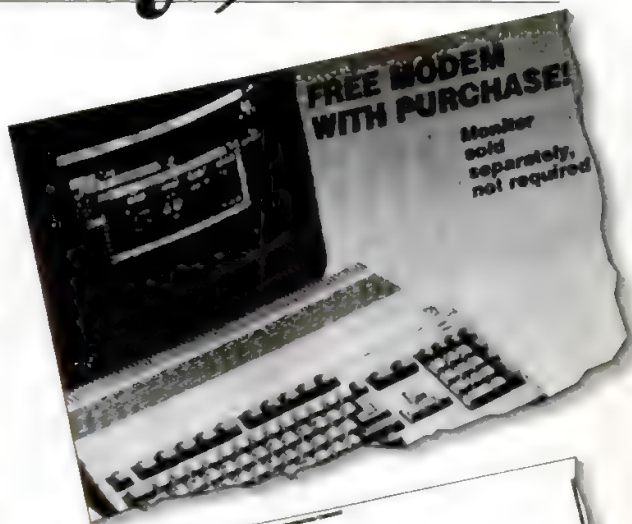
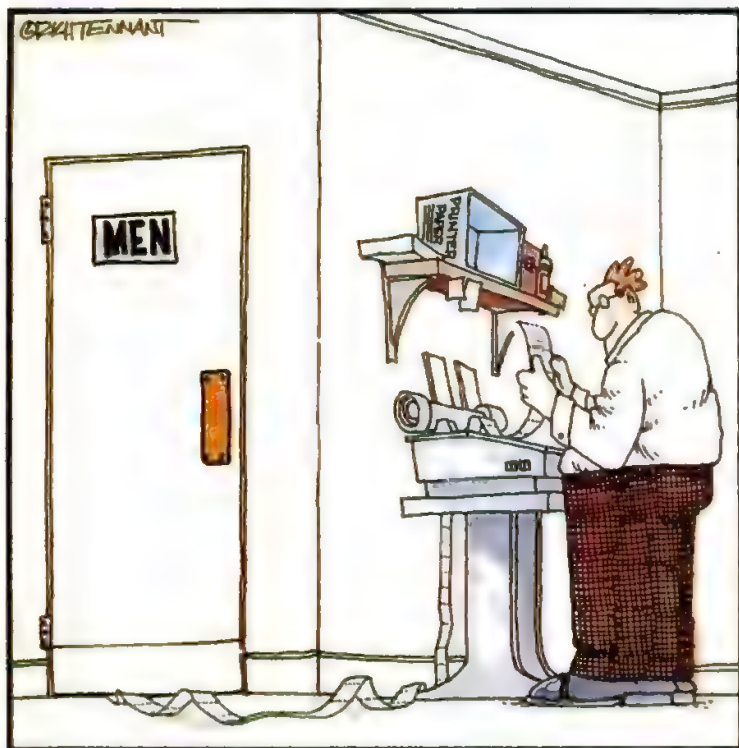
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4. How many PCs does your company plan to purchase in the next twelve months?

Quantity	Timeframe	Quantity	Timeframe
_____	Less than 1 month	_____	6-12 months
_____	1-3 months	_____	More than 12 months
_____	3-6 months		

5. What do you plan to use computer products for?

6. How many PCs do you have installed now at your company?

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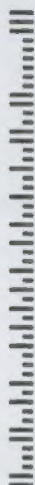


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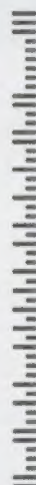


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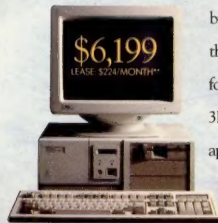
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